# STATE HIGHWAY PRESERVATION REPORT FEBRUARY 2003

**Produced by the Operations Analysis Division**

*A recycling "train" makes its way down Bower's Mansion Road (State Route 429) through Washoe Valley. In-place recycling of pavement saves materials and money, and is a key strategy in maintaining Nevada's extensive network of low-volume roads.*

## WHAT IS THE CONDITION OF NEVADA'S ROADS AND BRIDGES?

*Step 1: A powerful milling machine grinds the pavement surface, and conveys the ground material into a mobile processor. To control dust, a water truck (not seen) pumps directly into the milling machine.*

*Step 2: Ground pavement is dried and blended with rejuvenating chemicals and fresh asphalt oil in the mobile processing plant. The revitalized material is windrowed as it exits the plant.*

## WHAT IS BEING DONE TO PROTECT AND IMPROVE THEM?

*Step 3: The windrowed paving material is scooped up and conveyed into the hopper of the paving machine. The paving machine and its skilled operator lay down a ribbon of newly recycled blacktop.*

## HOW MUCH WILL IT COST?

*Step 4: Rubber-tired and steel-wheeled rollers compact the pavement. Shortly thereafter, the road is opened to traffic.*


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State of Nevada
Department of Transportation

# State Highway Preservation Report

Report to the 2003 Legislature
As Required by Nevada Revised Statute 408.203 (3)

February 2003

## Nevada Revised Statute 408.203(3)

The director of the Nevada Department of Transportation shall report to the Legislature by February 1 of odd-numbered years the progress being made in the department's 12-year plan for the resurfacing of state highways. The report must include an accounting of revenues and expenditures in the preceding two fiscal years, a list of the projects which have been completed, including mileage and cost, and an estimate of the adequacy of projected revenues for timely completion of the plan.

### Nevada Department of Transportation Mission

To efficiently plan, design, construct and maintain a safe and effective transportation system for Nevada's economic, environmental, social and intermodal needs.

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# EXECUTIVE SUMMARY

The *State Highway Preservation Report* is created biennially by the Nevada Department of Transportation to summarize our work to preserve the state highway system. This report also provides the Legislature with a tool to discern whether highway-preservation taxes are adequate. With regard to our state-maintained highways, this report answers the following questions: How do we fund their preservation? How do we care for them? What is their condition? What will they cost to maintain? What are we doing to protect and improve them? How has their condition changed over time?

**Backlog of Pavement & Bridge Preservation Work**
**With Present Funding vs. Needed Funding**

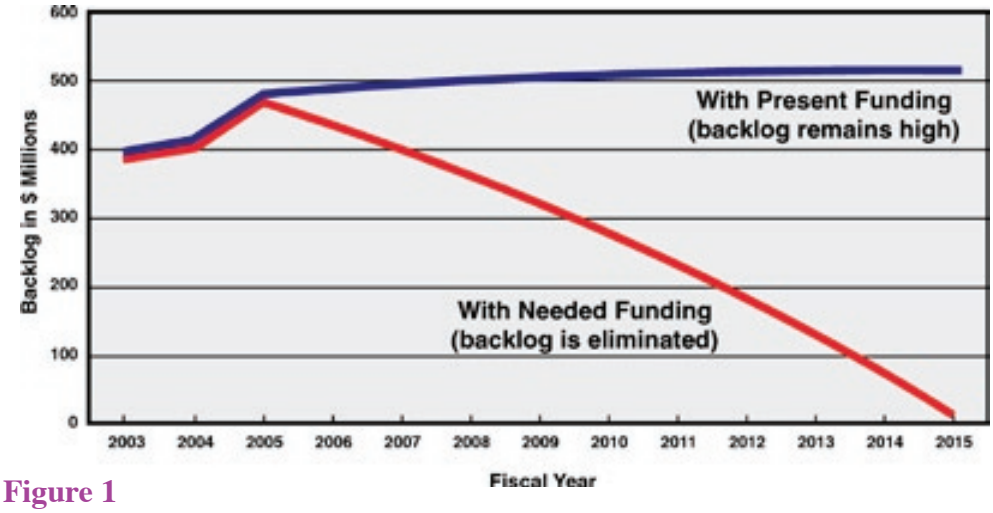



**Figure 1**

At the beginning of fiscal year 2003, there was a $387 million backlog of preservation work: $263 million for pavement and $124 million for bridges. During the last biennium, the backlog was reduced $96 million from the $483 million reported in 2001. Even more impressive, the backlog was reduced $283 million from the $670 million reported in 1999. Under present funding, the backlog is expected to rise gradually during the next 10 years to $518 million, and then settle at $513 million in 2015.

At $263 million, the 2003 pavement backlog is $74 million less than the $337 million we reported at the beginning of fiscal year 2001. Yet, during fiscal years 2001 and 2002, our department spent just $202 million on overlay and reconstruction work, or about $54 million less than the inflation-adjusted biennial average. Evidently, the backlog reduction was not driven by high expenditures, but by adherence to our proactive action plan for preserving pavement (as originally detailed in our 1999 report and then modified in our 2001 report). As a result, Nevada now has the highest portion of roads on the National Highway System that are in the "very good" category, per Federal Highway Administration standards. Because we are accomplishing our goal of reducing the backlog while keeping high- to moderate-volume roads in superior condition, we intend to continue with our proactive strategy. We have also made progress in developing more cost-effective ways to preserve our low-volume routes, and in coordinating routine pavement maintenance work with overlay and reconstruction projects.

Figure 1 shows how the backlog of pavement and bridge work is expected to change during the next 12 years under present funding and if the needed funding were applied. Table 1 shows the components of the fiscal year 2003 backlog.

## Backlog of Pavement and Bridge Work

State-Maintained System - 2003

Based on 2002 Condition Data

| System | Pavement | Bridges | Bridge Seismic Retrofit | Total |
|---|---|---|---|---|
| Principal Arterial - Interstate | $40,853,000 | $23,632,000 | - - | $64,485,000 |
| Principal Arterial - Non-Interstate | 56,738,000 | 16,283,000 | - - | $73,021,000 |
| Minor Arterial | 53,000,000 | 5,971,000 | - - | $58,972,000 |
| Major Collector | 76,133,000 | 9,455,000 | - - | $85,588,000 |
| Minor Collector & Local | 36,160,000 | 3,630,000 | - - | $39,790,000 |
| System Not Identified | - - | - - | $65,000,000 | $65,000,000 |
| **Total** | **$262,884,000** | **$58,972,000** | **$65,000,000** | **$386,856,000** |

Table 1

## Pavement Condition of the State-Maintained System

**By Repair Strategy Required and Functional Class**

**2002 Condition Data**

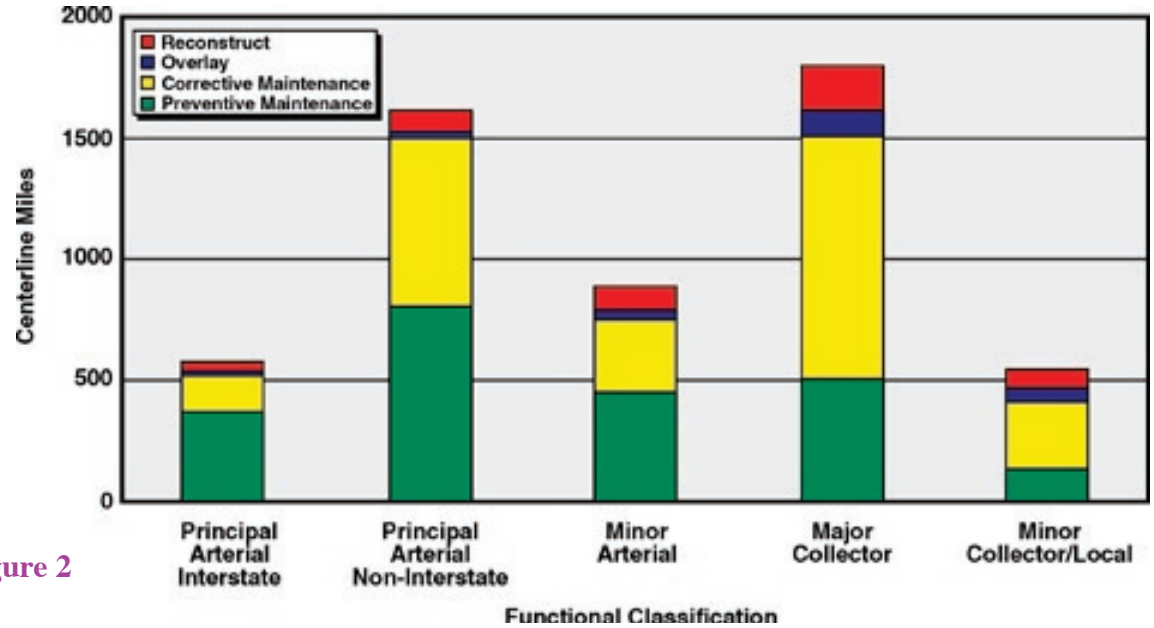



Figure 2

Of the 5,328 miles of state-maintained highways surveyed, 714 miles (13 percent) are in need of overlay or reconstruction. There are 584 fewer miles needing overlay or reconstruction in 2003 as compared to 2001. Our action plan to address the remaining pavement backlog relies on continuing to apply timely overlays on our Interstate and other principal arterials, minor arterials, and other moderate to high-volume roads; to further develop economical repair strategies for our low-volume roads; and to continue coordinating our routine maintenance activities with overlay and reconstruction work.

**Condition of Nevada's Bridges**

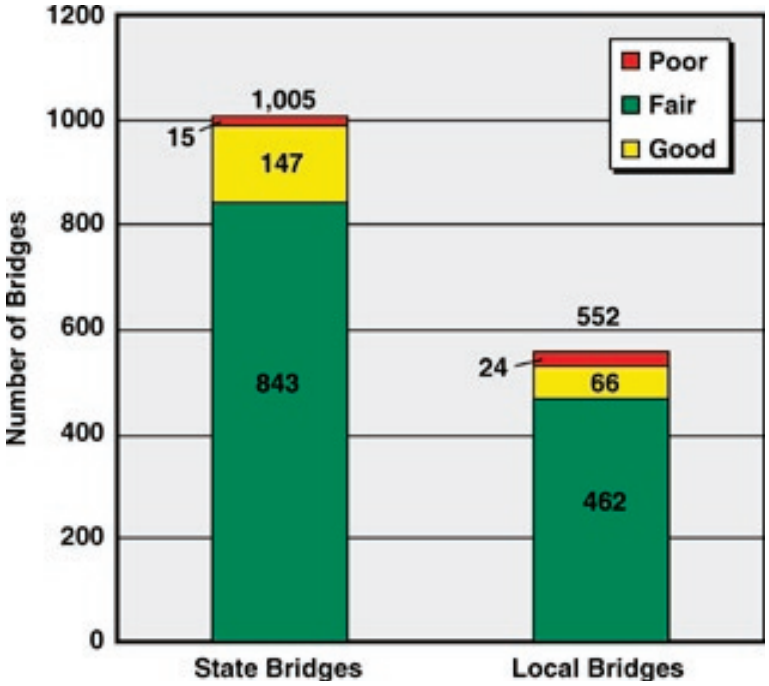



Figure 3

Because Nevada's bridges are relatively young and located in a generally warm, arid climate, they are in good condition compared to bridges in most states. There are 1,005 bridges on the state-maintained system. Twenty-one (2.1 percent) are functionally obsolete and no longer provide adequate service to the public. Another 35 (3.5 percent) are structurally deficient. Since 1995, when NDOT began prioritizing bridges for seismic retrofits, it has replaced or retrofitted nearly 70 structures. A high priority exists for seismic retrofit of at least 240 more state-owned bridges.

Nevada spends about $15 million annually on bridge preservation: $11 million in federal funds, $3 million in state funds, and $1 million in local funds. The state and federal funds are considered minimally adequate to preserve the state-maintained bridges during the next seven years. Because bridges normally have a useful life of about 50 years, we expect increased costs during the 2010s when many bridges will be due for major work.

**50-Year Old State Bridges**

An Estimate of When Bridges May Need Major Work

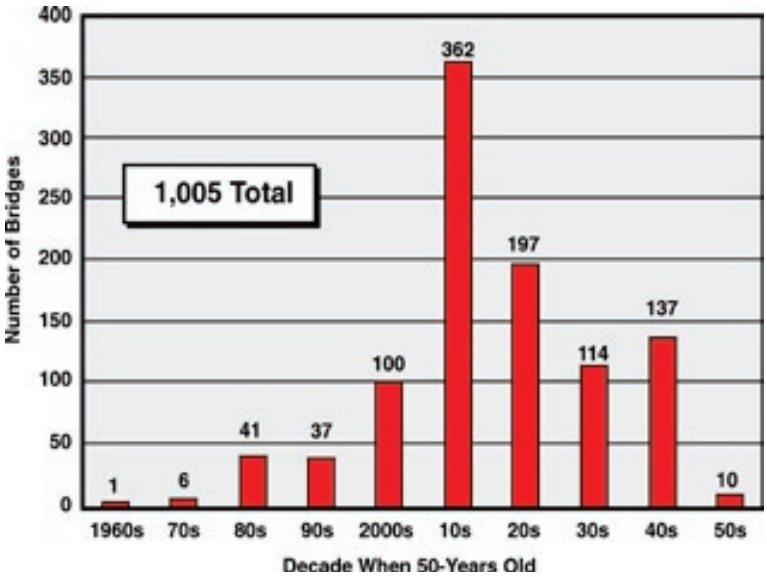



Figure 4

# INTRODUCTION

As required by Nevada Revised Statute 408.203(3), this report details our efforts to preserve Nevada's state highways. With regard to our state-maintained highways, this report answers the following questions: How do we fund their preservation? How do we care for them? What is their condition? What will they cost to maintain? What are we doing to protect and improve them? How has their condition changed over time?

The Nevada Department of Transportation maintains 5,472 miles of highways. Of these highways 5,328 miles were surveyed for this report. Overwhelmingly, these highways are the most important in the state, carrying 59 percent of all traffic and 89 percent of all heavy trucks. Also, 1,005 of Nevada's 1,623 public bridges are located on these highways.

## Nevada Department of Transportation's Role

Our investment in highways is substantial. Today's cost to replace the pavement surface alone is $3 billion. The Nevada Department of Transportation is responsible for protecting highway assets, and preserving existing highways is a top priority.

Highway assets are managed using two systems: A pavement management system and a bridge inventory system. Both systems provide an inventory of our existing assets, their condition, needed repairs, and repair priorities. Repair costs are determined to forecast short- and long-term funding requirements.

## Legislature's Role

The Nevada Department of Transportation depends on taxes authorized by Congress and the Nevada Legislature to preserve our highways. Since 70 percent of our highway-preservation funds are derived from state-levied taxes, the Legislature's involvement is critical to our success. This report provides the Legislature with a tool to determine whether those taxes are adequate.

# PAVEMENT PRESERVATION

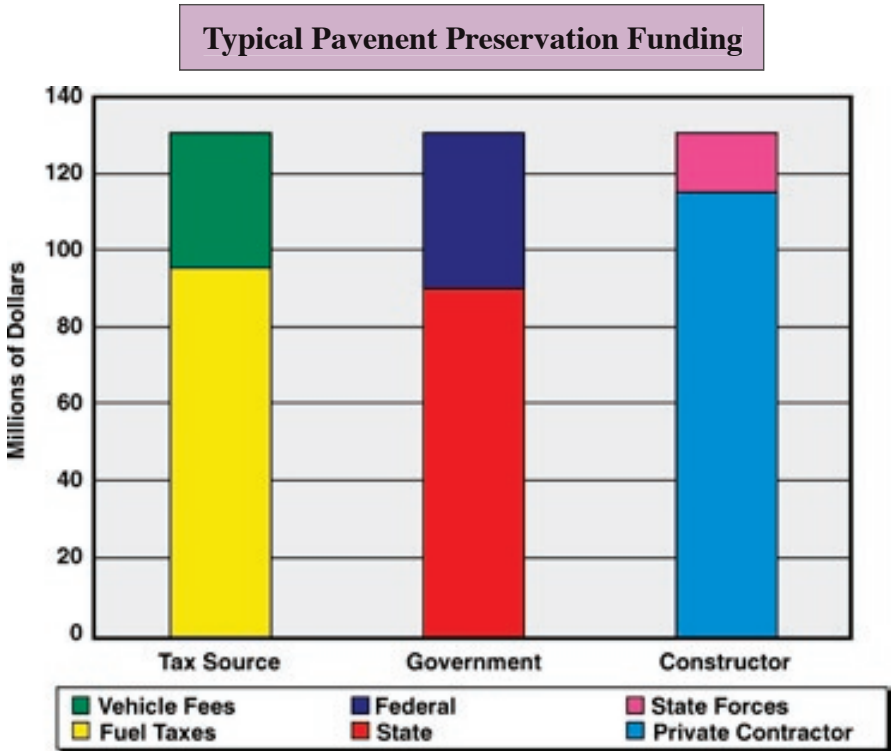
Generally, pavement-preservation work consists of sealing, crack filling, patching, milling, overlaying, or reconstructing the highway surface. Sealing, crack filling, and patching are typically accomplished by Nevada Department of Transportation maintenance crews. Milling, overlaying, or reconstructing the highway surface is normally contracted.

Because it represents a $3 billion investment, preserving pavement is a top priority for the Nevada Department of Transportation. Well-preserved pavements also provide the smooth ride that the public demands.

This section provides details concerning preservation funding, our pavement management system, the state-maintained highway inventory, pavement condition, the cost to preserve our pavements, available and needed preservation funding, and an action plan for maintaining high-quality, low-cost pavement.

**Funding** *(How do we pay for pavement preservation?)*

Nevada's state highways are financed by highway-user taxes — predominantly fuel taxes and vehicle registration fees. Typically, about $130 million is spent annually on pavement-preservation projects: $40 million is federal funds for Interstate maintenance, and $90 million is state funds. Of the $130 million spent annually, typically $115 million is contracted and $15 million is performed by Nevada Department of Transportation maintenance forces.




Timely preservation work is critical to achieving low-cost pavements. Preservation work, however, must compete for funding against capacity-improvement projects in our fast-growing state. During the last two fiscal years, $202 million were spent on overlay and reconstruction. Although this expenditure is $54 million less than the inflation-adjusted biennial average, timely and efficient application of the $202 million yielded a $74 million reduction in the pavement backlog.

**Figure 5**

**Pavement Management** *(How do we care for pavement assets?)*

Pavement assets are monitored via our Pavement Management System. This system provides an inventory of pavement location and its corresponding condition, traffic volumes, weather, maintenance costs, and accidents. The Pavement Management System allows us to improve the efficiency of our decision-making, expand its scope, provide feedback as to the consequences of decisions, and ensure the consistency of decisions made at different levels within the Department.

**Pavement Condition** *(How do we assess the health of our pavements?)*

The health of our pavements is assessed based on the age and type of pavement, route type, traffic volume, axle loads, and measured pavement distress.

The condition of the moderate- to high-volume routes is based on pavement age and type, route type, traffic volume, and axle loads as shown in Table 2 below. These routes have two-way average daily traffic greater than 400 vehicles per day. Generally, the Interstate and other principal arterials, minor arterials, and major collectors are moderate- to high-volume routes; however, some of the minor collector and local routes are also included.

**Pavement Repair Strategy Determination for Moderate- to High-Volume Routes**
**Two-way average daily traffic greater than 400 vehicles**
Controlled-access highways, National Highway System routes,
and non-controlled-access highways

| Route Parameters | Pavement Type | Repair Strategy (based on pavement age in years) | | | |
|---|---|---|---|---|---|
| | | Preventive Maintenance | Corrective Maintenance | Overlay | Reconstruct |
| Interstates, Freeways, and All Other Controlled-Access Highways | Asphalt | Age ≤ 4 years | 4 < Age < 8 years | Age 8 years | Age > 8 years |
| | Concrete | Age ≤ 10 | 10 < Age < 18 | N/A | Age > 18 |
| Non-Controlled-Access Highways with: ADT > 10,000 or ESAL > 540 | Asphalt | Age ≤ 4 | 4 < Age < 10 | Age 10 | Age > 10 |
| Non-Controlled-Access Highways with: 1,600 < ADT ≤ 10,000 or 405 < ESAL ≤ 540 Or National Highway System routes with ADT ≤ 10,000 | Asphalt | Age ≤ 4 | 4 < Age < 12 | Age 12 | Age > 12 |
| Non-Controlled-Access Highways off the National Highway System with: 400 < ADT ≤ 1,600 or 270 < ESAL ≤ 405 | Asphalt | Age ≤ 4 | 4 < Age < 15 | Age 15 | Age > 15 |

Notes: < means less than; ≤ means less than or equal to; > means greater than; 4 < Age < 8 years means the age is greater than 4 but less than 8
ADT = Average Daily Traffic (in vehicles per day)
N/A means Not Applicable; ESAL = Equivalent 18,000-pound Single-Axle Loads imparted daily. It takes 2,500 cars to impart a single ESAL but just one modest-sized truck.

**Table 2**

Low-volume routes have two-way average daily traffic of up to 400 vehicles per day. They provide access to the higher-volume roads. Generally, they are minor collectors and local routes, but there are some minor arterials and major collectors that also are low-volume roads. The condition of these routes is based on pavement distress. To measure distress, a section within each mile of highway in each direction of highway is rated. The severity and extent of the following pavement distresses are measured:

**Distresses Measured**

| | |
|---|---|
| Road Roughness | Fatigue Cracking |
| Rut Depth | Transverse Cracking |
| Patching | Block Cracking |
| Flushing | Non-Wheel-Path Longitudinal Cracking |
| Friction Loss | |

The measured distresses are assigned points. These points are summed and a repair strategy is assigned as follows:

**Pavement Repair Strategy Determination for Low-Volume Routes**
**Two-way average daily traffic less than or equal to 400 vehicles**
Non-controlled-access highways off the National Highway System

| | | Repair Strategy (based on pavement distress data) | | | |
|---|---|---|---|---|---|
| **Route Parameters** | **Pavement Type** | **Preventive Maintenance (points)** | **Corrective Maintenance (points)** | **Overlay (points)** | **Reconstruct (points)** |
| ADT ≤ 400 | Asphalt | 0 to 49 | 50 to 399 | 400 to 699 | >700 |

Notes: <, less than; ≤, less than or equal to; >, greater than; ADT = Average Daily Traffic (in vehicles per day)

**Table 3**

Other conditions factored into the assessment of pavement are weather, traffic loads and maintenance costs. Figure 6 shows the typical conditions of roadways needing these repair strategies.

Preventive Maintenance

Corrective Maintenance

Overlay

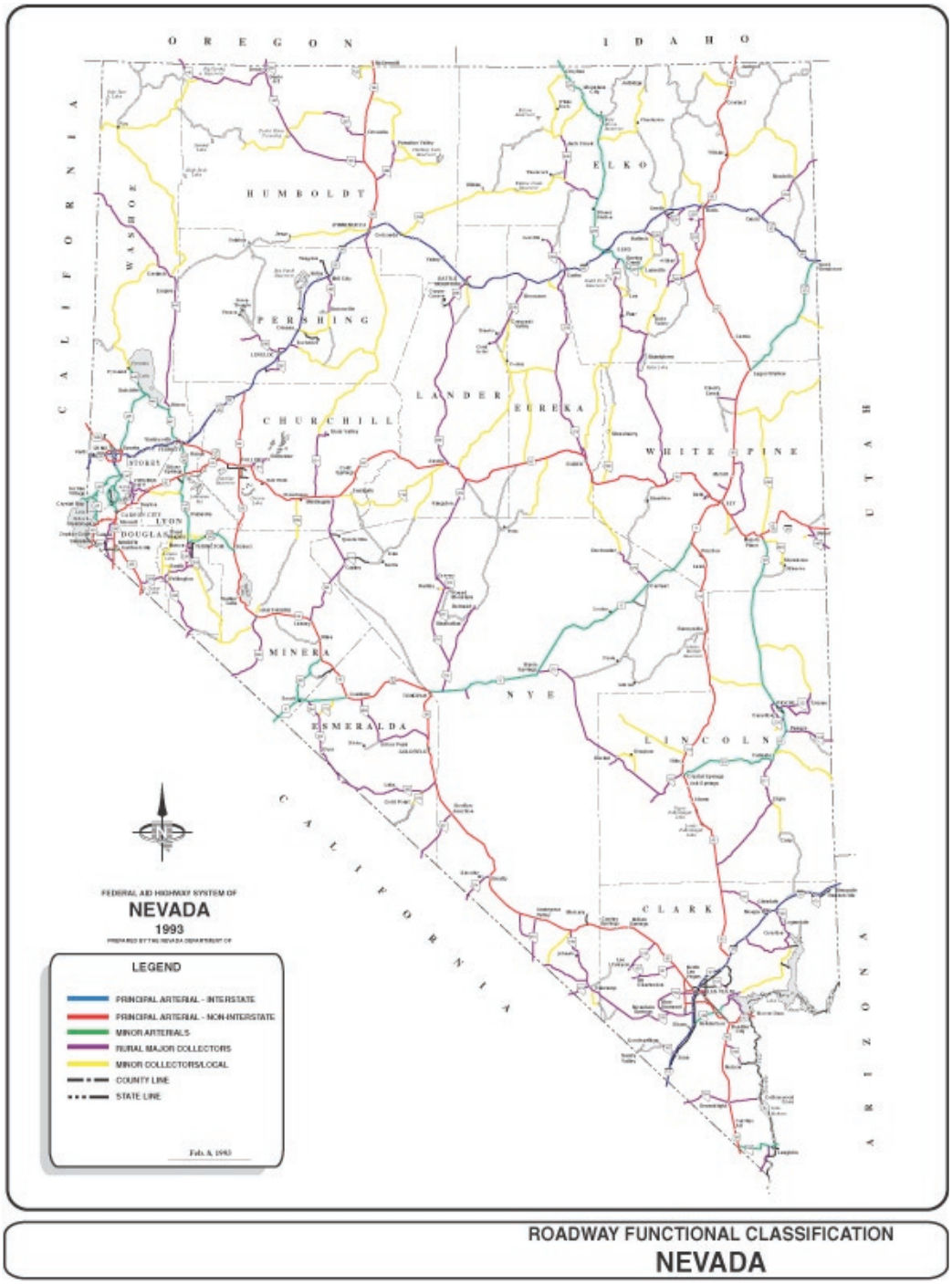
Reconstruct

**Figure 6.** Typical roadway condition for repair strategy assigned.

## System Status *(What do we maintain?; What is its condition?; What is the cost to improve it?)*

### *Highway Inventory (What do we maintain?)*

The Nevada Department of Transportation is responsible for maintaining 5,472 miles of highways. Of these highways, 5,328 miles were surveyed for this report. These highways are functionally classified by federal standards. The functional classifications are made to discern the relative importance and capacity of the highway. In this report, state-maintained highways are grouped under these functional classes: principal arterials, minor arterials, major collectors, minor collectors, and local. Figure 7 shows those functional classes with state-maintained highways depicted by route markers. Figures 8 and 9 show the pavement repair strategies by functional class.




ROADWAY FUNCTIONAL CLASSIFICATION
NEVADA

**Figure 7**

## Condition Survey results *(What is the condition of our pavement?)*

The 2002 pavement condition survey shows that of the 5,328 miles of state-maintained highway, 246 miles are presently in need of an overlay (561 miles less than the 2000 evaluation of 807 miles) and 468 miles need to be reconstructed. Combined, the total overlay and reconstruction needs are 714 miles (13 percent of the system). Figures 8 and 9 show the repair strategies required for each functional class. Table 4 on page 13 illustrates the same information in tabular form. Figure 10 shows the roads that are in need of overlay or reconstruction.

**Pavement Condition on the State-Maintained System**
**By Repair Strategy Required and Functional Class - 2002 Condition Data**

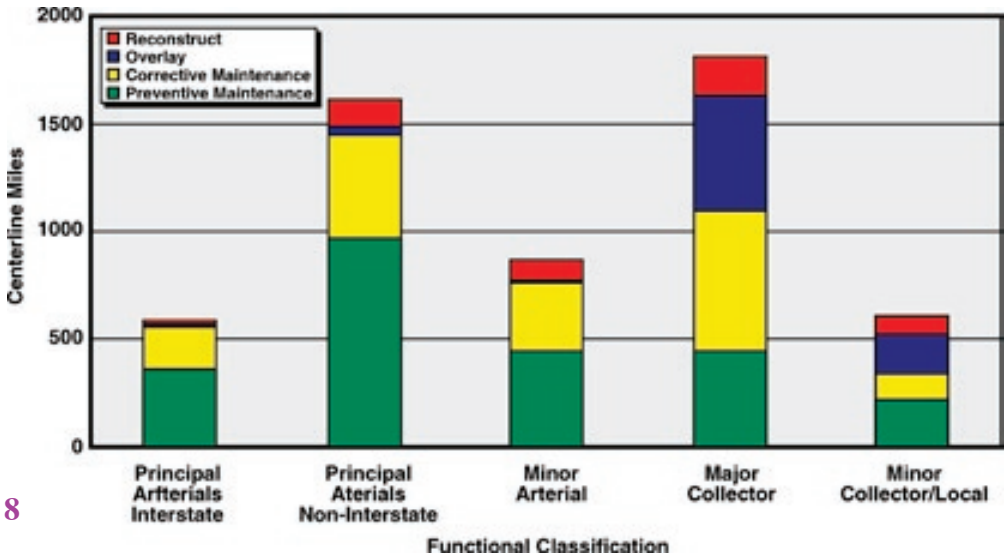



Figure 8

**Pavement Condition on the State-Maintained System**
**By Functional Class and Repair Strategy Required - 2002 Condition Data**

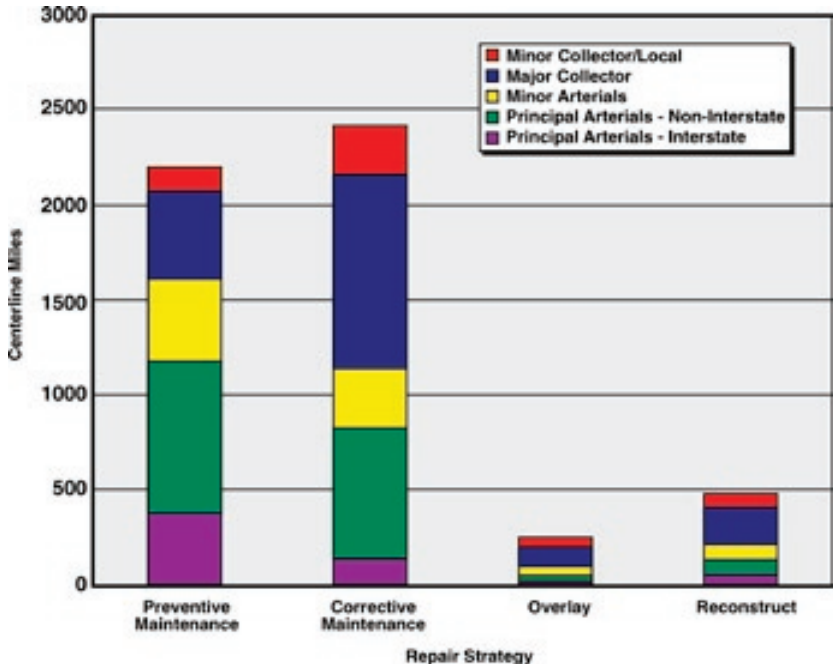



Figure 9

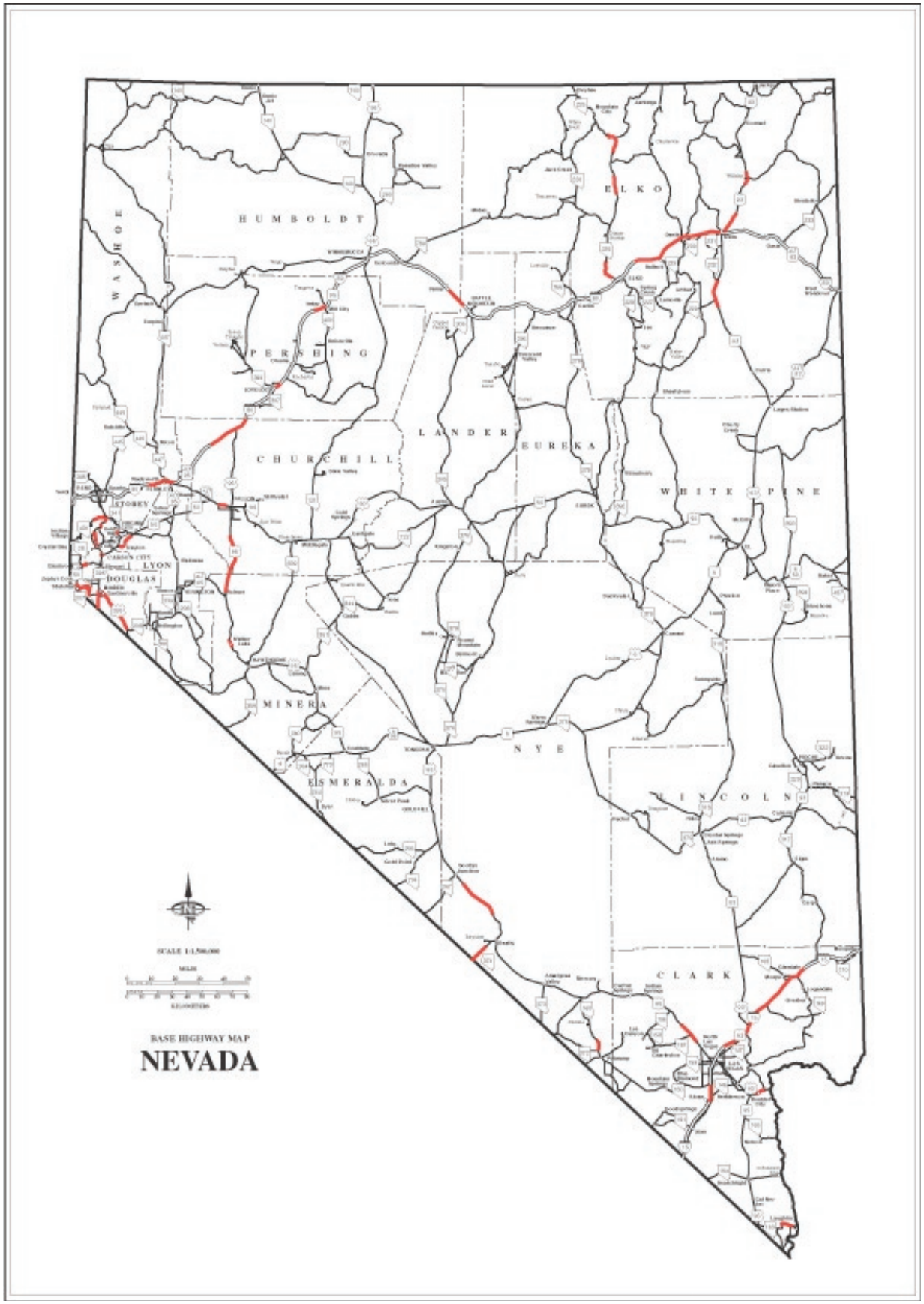



**Figure 10.** Roads Planned for Overlay or Reconstruct in Fiscal Years 2003 and 2004.

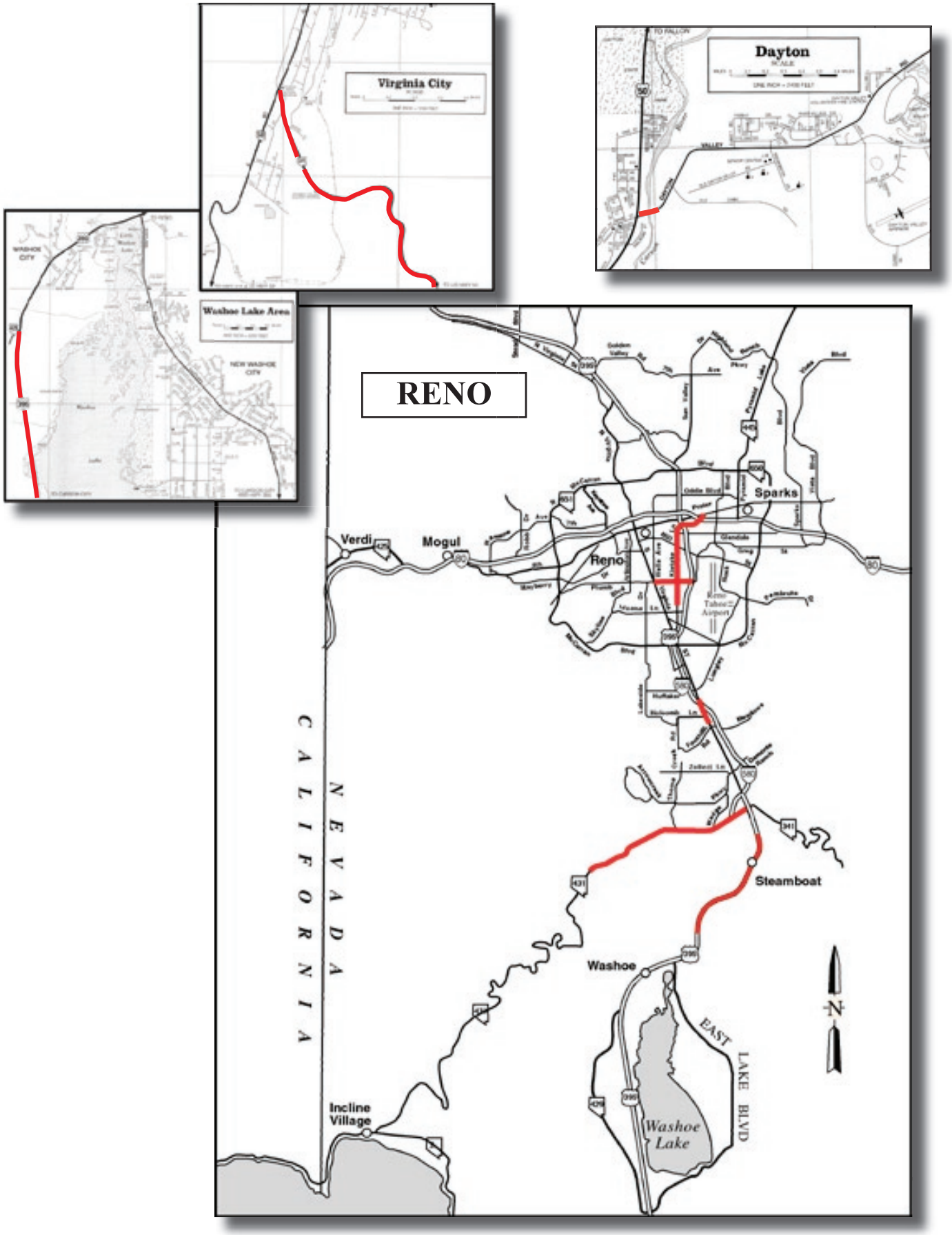



**Figure 10A.** Roads Planned for Overlay or Reconstruct in Fiscal Years 2003 and 2004.


**Figure 10B.** Roads Planned for Overlay or Reconstruct in Fiscal Years 2003 and 2004.

## Pavement Condition on the State-Maintained System - 2003
### By Repair Strategy Required
Based on 2002 Condition Data

**CENTERLINE MILES**

| System | Repair Strategy Required: Preventive Maintenance | | Corrective Maintenance | | Overlay | | Reconstruct | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Principal Arterial - Interstate | 381 | 7.2% | 135 | 2.5% | 10 | 0.2% | 37 | 0.7% | 563 | 10.6% |
| Principal Arterial - Non-Interstate | 797 | 15.0% | 694 | 13.0% | 29 | 0.5% | 84 | 1.6% | 1,604 | 30.1% |
| Minor Arterial | 436 | 8.2% | 300 | 5.6% | 44 | 0.8% | 87 | 1.6% | 867 | 16.3% |
| Major Collector | 473 | 8.9% | 1,019 | 19.1% | 105 | 2.0% | 191 | 3.6% | 1,787 | 33.5% |
| Minor Collector & Local | 108 | 2.0% | 271 | 5.1% | 59 | 1.1% | 70 | 1.3% | 507 | 9.5% |
| **Total** | **2,195** | **41.2%** | **2,419** | **45.4%** | **246** | **4.6%** | **468** | **8.8%** | **5,328** | **100.0%** |

**LANE MILES**

| System | Repair Strategy Required: Preventive Maintenance | | Corrective Maintenance | | Overlay | | Reconstruct | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Principal Arterial - Interstate | 1,549 | 11.9% | 554 | 4.3% | 39 | 0.3% | 173 | 1.3% | 2,314 | 17.8% |
| Principal Arterial - Non-Interstate | 1,897 | 14.6% | 1,633 | 12.6% | 98 | 0.8% | 260 | 2.0% | 3,888 | 30.0% |
| Minor Arterial | 1,101 | 8.5% | 660 | 5.1% | 116 | 0.9% | 256 | 2.0% | 2,132 | 16.4% |
| Major Collector | 960 | 7.4% | 2,057 | 15.9% | 209 | 1.6% | 386 | 3.0% | 3,612 | 27.9% |
| Minor Collector & Local | 221 | 1.7% | 541 | 4.2% | 118 | 0.9% | 141 | 1.1% | 1,022 | 7.9% |
| **Total** | **5,728** | **44.2%** | **5,444** | **42.0%** | **580** | **4.5%** | **1,217** | **9.4%** | **12,969** | **100.0%** |

**Table 4.** Pavement Condition on the State-Maintained System

*Backlog of Pavement Work* *(What is the current cost to improve our roads to good condition?)*

We want to have all our pavements in good condition. Table 4 identifies how much work in each repair strategy would be required to achieve this. Table 5 shows that the current cost to get there is $263 million. Only those pavements from Table 4 that require overlay or reconstruct strategies are included in calculating our current backlog because they are in poor condition. Pavements in the preventive and corrective maintenance categories are not included in the backlog because they are in fair to good condition and can be adequately maintained with our routine-maintenance funds.

## Backlog of Overlay and Reconstruction Work
### State-Maintained System - 2003
### Based on 2002 Condition Data

| | Overlay | | Reconstruct | | Total | |
|---|---|---|---|---|---|---|
| System | Lane Miles | Cost | Lane Miles | Cost | Lane Miles | Cost |
| Principal Arterial - Interstate | 39 | $5,428,000 | 173 | $35,425,000 | 212 | $40,853,000 |
| Principal Arterial - Non-Interstate | 98 | 12,099,000 | 260 | 44,639,000 | 358 | 56,738,000 |
| Minor Arterial | 116 | 11,425,000 | 256 | 41,575,000 | 372 | 53,000,000 |
| Major Collector | 209 | 19,089,000 | 386 | 57,044,000 | 595 | 76,133,000 |
| Minor Collector & Local | 118 | 15,033,000 | 141 | 21,127,000 | 259 | 36,160,000 |
| **Total** | **580** | **$63,074,000** | **1,216** | **$199,810,000** | **1,796** | **$262,884,000** |

**Table 5**

The backlog shown in Table 5 includes the costs for pavement, ancillary repairs, and engineering on a project. Ancillary repairs typically include repairing signs and signals, replacing guideposts, repairing ditches and culverts, and grading shoulders.

**2003 Action Plan** *(In general, how will we improve our pavements?; How do we prioritize the work?; What financial resources are needed?)*

Preserving high-quality pavement at low cost requires an action plan that optimizes the use of available funds. As a result of the proactive action plan originally detailed in our 1999 report and then modified in our 2001 report, Nevada now has the highest portion of roads on the National Highway System that are in the "very good" category, per Federal Highway Administration standards. This year's action plan changed scarcely from that of our 2001 report because we are accomplishing our goal of keeping high- to moderate-volume roads in superior condition by overlaying them before more expensive reconstruction is needed. We have also made progress in developing more cost-effective ways to preserve our low-volume routes and coordinating routine pavement maintenance work with overlay and reconstruction projects. Our action plan in priority order consists of the following tasks:

1. Continue to maintain our Interstate system and high-volume roads at a high level of serviceability by applying timely overlays and reconstructing inferior segments.
2. Continue to maintain our non-Interstate principal arterials, minor arterials, and other moderate-volume roads at a modest to high level of serviceability by applying timely overlays and reconstructing inferior segments.
3. To further develop economically sound methods to improve our low-volume roads and maintain them at a limited, but acceptable, level of serviceability.
4. To continue coordinating and integrating our routine pavement maintenance activities with planned overlay and reconstruction work.

**2001 Action Plan**

1. Continue to maintain our Interstate system and high-volume roads at a high level of service-ability by applying timely overlays and reconstructing inferior segments.
2. To maintain our non-Interstate principal arterials, minor arterials, and other moderate-volume roads at a modest to high level of serviceability by applying timely overlays and reconstructing inferior segments.
3. To further develop economically sound methods to improve our low-volume roads and maintain them at a limited, but acceptable, level of serviceability.
4. To better coordinate and integrate our routine pavement maintenance activities with planned overlay and reconstruction work.

**1999 Action Plan**

1. Complete the reconstruction of the inferior segments of our Interstate highways.
2. Apply timely overlays on Interstate highways.
3. Overlay or reconstruct inferior segments of the non-Interstate principal arterials and minor arterials.
4. Apply timely overlays on all non-Interstate routes.

When even modest pavement distresses appear, the cost to repair a road skyrockets. By continuing our proactive approach of overlaying the road before these distresses appear, we can produce significant savings. This is the impetus behind our plan to apply timely overlays in tasks 1 and 2 of the action plan. Based primarily on pavement age, traffic volume, and traffic loads, we can predict when distresses will appear and perform the overlays in advance of these distresses. This proactive technique is overwhelmingly responsible for reducing the pavement backlog reported in 1999 from $528 million to the current $263 million. Inflation-adjusted average annual expenditures for fiscal years 1999 through 2002 were $134 million, or just $6 million more than the historic inflation-adjusted average of $128 million. Irrespective of this minor additional funding, our proactive plan has reduced the pavement backlog by an average of $61 million annually, while keeping our pavement in great condition.

As noted in task 1 of our action plan, we are continuing to apply timely overlays on the Interstate before the affected road segments deteriorate to the point where more expensive reconstruction is needed. However, there are some sections of the urban Interstate in the Reno and Las Vegas areas that will require reconstruction, probably in fiscal year 2006.

Likewise, under task 2 of our action plan, we will continue to place timely overlays on non-Interstate principal arterials, minor arterials, and other moderate-volume roads. On these routes, the few inferior segments that were identified for the 2001 action plan were reconstructed in 2002 and 2003.

Although they are not subjected to heavy traffic loads, our low-volume roads are still expensive to maintain because they are extensive. Because we have accomplished our goals for the more heavily traveled routes, we are now focusing on low-volume routes under task 3 of the action plan. Some of these roads have been repaired using recycling, cold-mix overlays, chemical stabilization, and double chip-seal applications. Many of these applications are under long-term study because we need additional economically viable repair strategies for low-volume roads.

Under task 4 of the action plan, we have begun to strategically coordinate routine pavement maintenance activities and our overlay and reconstruction work. Some of this coordination is detailed in the previous paragraph, but more will come from our new Low-Volume Road Task Force. Ultimately, we must assure that routine-maintenance repair strategies are consistent with plans for more extensive repairs.

*Project Priorities* *(How do we prioritize individual projects?)*

Our action plan tells how we prioritize preservation of the highway network as a whole. Within the goals of our action plan, we prioritize individual projects based on pavement age, traffic volume, axle loads, and condition. This prioritization scheme is consistent with the method by which we assess the health of our pavements.

A list of statewide candidate pavement preservation projects is developed, and the projects are ranked based on the financial consequences of not doing the projects in a timely manner. For example delaying a project on the Interstate system by one year can add several million dollars to the cost; whereas, delays on a moderate- or low-volume road will have a less significant impact. A field-survey team reviews these candidate projects and refines the repair strategy to be used. The team also recommends an appropriate funding level to accomplish our preservation goals for the year. In addition, we include input from our district engineers to fairly allocate the modest funding available for low-volume routes.

*Present versus Needed Funding* *(What financial resources are needed to improve our pavements?)*

Under the present user-fee structure, the current $263 million backlog of pavement work will increase to $313 million in 2015. The needed funding scenario, which requires moderate revenue increases in future years, will close out the backlog in 2015. Figure 11 and Table 6 show how these increases are needed to eliminate the backlog.

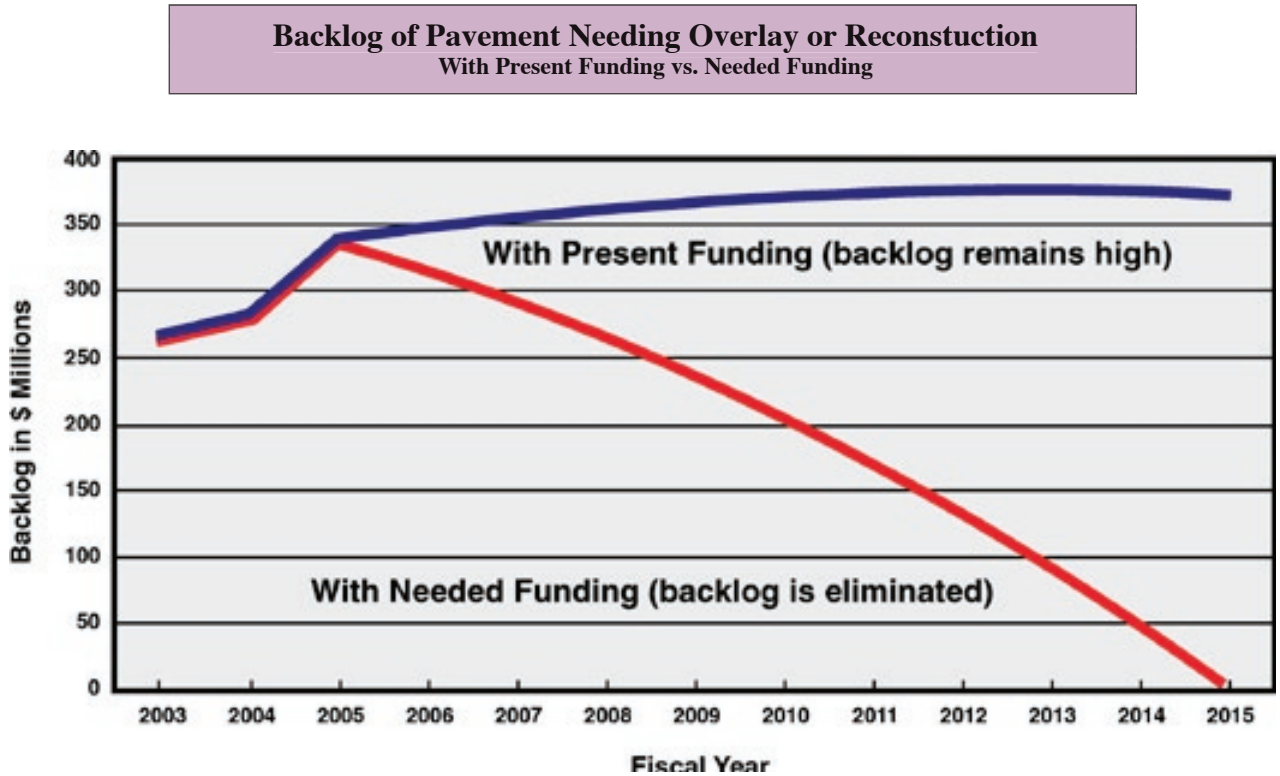



**Figure 11**

## Pavement Backlog, Costs, and Funding
**State-Maintained System - 2003 (in millions of dollars)**

### With Present Funding (backlog remains high)

| | | Pavement Preservation Costs* (Normal Annual Deterioration Costs) | | | Pavement Preservation Funds** (Funds Planned for Preservation Work) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fiscal Year | Backlog of Pavement Work | Overlay & Reconstruction | Preventive & Corrective Maintenance | Total | State Overlay & Reconstruction | Federal Overlay & Reconstruction | State Preventive & Corrective Maintenance | | Total |
| 2003 | 262.9 | 141.1 | 10.9 | 152.0 | 95.6 | 29.1 | 10.9 | | 135.6 |
| 2004 | 220.6 | 145.3 | 11.2 | 156.5 | 45.5 | 42.3 | 11.2 | | 99.0 |
| 2005 | 278.1 | 149.7 | 11.6 | 161.2 | 94.4 | 44.0 | 11.6 | | 150.0 |
| 2006 | 289.3 | 154.1 | 11.9 | 166.1 | 100.0 | 45.8 | 11.9 | | 157.7 |
| 2007 | 297.7 | 158.8 | 12.3 | 171.0 | 104.0 | 47.6 | 12.3 | | 163.8 |
| 2008 | 304.9 | 163.5 | 12.6 | 176.2 | 108.2 | 49.5 | 12.6 | | 170.3 |
| 2009 | 310.8 | 168.4 | 13.0 | 181.5 | 112.5 | 51.5 | 13.0 | | 177.0 |
| 2010 | 315.3 | 173.5 | 13.4 | 186.9 | 117.0 | 53.5 | 13.4 | | 183.9 |
| 2011 | 318.3 | 178.7 | 13.8 | 192.5 | 121.7 | 55.7 | 13.8 | | 191.1 |
| 2012 | 319.6 | 184.1 | 14.2 | 198.3 | 126.5 | 57.9 | 14.2 | | 198.6 |
| 2013 | 319.3 | 189.6 | 14.6 | 204.2 | 131.6 | 60.2 | 14.6 | | 206.4 |
| 2014 | 317.1 | 195.3 | 15.1 | 210.4 | 136.9 | 62.6 | 15.1 | | 214.6 |
| 2015 | 312.9 | | | | | | | | |

### With Needed Funding (backlog is eliminated)

| | | Pavement Preservation Costs* (Normal Annual Deterioration Costs) | | | Pavement Preservation Funds** (Funds Planned for Preservation Work) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fiscal Year | Backlog of Pavement Work | Overlay & Reconstruction | Preventive & Corrective Maintenance | Total | State Overlay & Reconstruction | Federal Overlay & Reconstruction | State Preventive & Corrective Maintenance | Needed Additional Overlay & Reconstruction | Total |
| 2003 | 262.9 | 141.1 | 10.9 | 152.0 | 95.6 | 29.1 | 10.9 | 0.0 | 135.6 |
| 2004 | 220.6 | 145.3 | 11.2 | 156.5 | 45.5 | 42.3 | 11.2 | 0.0 | 99.0 |
| 2005 | 278.1 | 149.7 | 11.6 | 161.2 | 94.4 | 44.0 | 11.6 | 26.1 | 176.0 |
| 2006 | 263.3 | 154.1 | 11.9 | 166.1 | 100.0 | 45.8 | 11.9 | 27.1 | 157.7 |
| 2007 | 244.6 | 158.8 | 12.3 | 171.0 | 104.0 | 47.6 | 12.3 | 28.1 | 163.8 |
| 2008 | 223.6 | 163.5 | 12.6 | 176.2 | 108.2 | 49.5 | 12.6 | 29.1 | 170.3 |
| 2009 | 200.2 | 168.4 | 13.0 | 181.5 | 112.5 | 51.5 | 13.0 | 30.5 | 177.0 |
| 2010 | 174.2 | 173.5 | 13.4 | 186.9 | 117.0 | 53.5 | 13.4 | 31.7 | 183.9 |
| 2011 | 145.4 | 178.7 | 13.8 | 192.5 | 121.7 | 55.7 | 13.8 | 33.0 | 191.1 |
| 2012 | 113.8 | 184.1 | 14.2 | 198.3 | 126.5 | 57.9 | 14.2 | 34.3 | 198.6 |
| 2013 | 79.2 | 189.6 | 14.6 | 204.2 | 131.6 | 60.2 | 14.6 | 35.7 | 206.4 |
| 2014 | 41.3 | 195.3 | 15.1 | 210.4 | 136.9 | 62.6 | 15.1 | 37.1 | 214.6 |
| 2015 | 0.0 | | | | | | | | |

* Inflation assumed at 3.00% per annum.
** Revenue growth rate assumed is 4.00% per annum.

Note: Backlog of bridge work is as of beginning of fiscal year; preservation costs are those incurred during the fiscal year; and preservation funds are those that are available during the fiscal year.

**Table 6**

*Pavement Management System Improvements* *(How will we improve our asset management?)*

Based on the overwhelming success of our action plan detailed earlier, the Nevada Department of Transportation will not make any major changes with regard to asset management, with the exception of continuing to improve the strategies used for low-volume roads.

*Pavement Research* *(What research are we conducting to improve our pavements?)*

We are reviewing the implementation of the SUPERPAVE mix design to see if it has performed as expected, and to determine whether it will need modification to achieve the desired results. Our Materials Division is researching durable pavement markings (including new environmental considerations), pavement crack-sealing materials and methods, ways to implement the use of pavement research products already in existence, the effects of temperature segregation of paving material, impact of construction variability on pavement performance, and we are participating in a national pooled-fund study which is a full-scale accelerated performance test and structural validation for SUPERPAVE.

In the summer of 2002, NDOT constructed the first low-volume road test section using some unconventional strategies on State Route 230. Some of the strategies included soil stabilization, roadbed modification, fabric underlay, and foamed-asphalt stabilization. Various methods of cold recycling, and single and double chip seals are recommended for a second test section, which is scheduled for the summer of 2003 on U.S. 6.

Several new strategies have been added to the existing rehabilitation methods. These strategies include hot in-place recycling, slurry seals, and foamed asphalt. Some of these strategies have been used in the past year and have saved millions of dollars.

## Historical Perspectives *(How much have we expended on pavements?; How has the condition changed?)*

*Biennial Expenditures, Fiscal Years 2001-2002* *(How much have we expended on pavements?)*

During fiscal years 2001 and 2002, NDOT obligated $202 million for pavement overlay and reconstruction work, addressing the needs of 404 miles of highways. Preventive and corrective maintenance work consisting of patching and sealing pavements was completed at a cost of $22 million. Table 7 summarizes expenditures, and Figure 12 shows those highways receiving overlays or reconstruction during the previous biennium.

### Pavement Expenditures and Miles of Highway Overlaid and Reconstructed

*Fiscal Years 2001 and 2002*

| | Repair Strategy | | | | | | |
|---|---|---|---|---|---|---|---|
| FiscalYear | Preventive & Corrective Maintenance | Overlay | | Reconstruct | | Total | |
| | Expenditures | Expenditures | Miles | Expenditures | Miles | Expenditures | Miles |
| 2001 | $7,891,883 | $77,552,265 | 177 | $4,243,781 | 16 | $89,687,929 | 193 |
| 2002 | $13,873,906 | $71,732,691 | 188 | $26,451,087 | 23 | $112,057,684 | 211 |
| **Biennium Total** | **$21,765,789** | **$149,284,956** | **365** | **$30,694,868** | **39** | **$201,745,613** | **404** |

**Table 7**

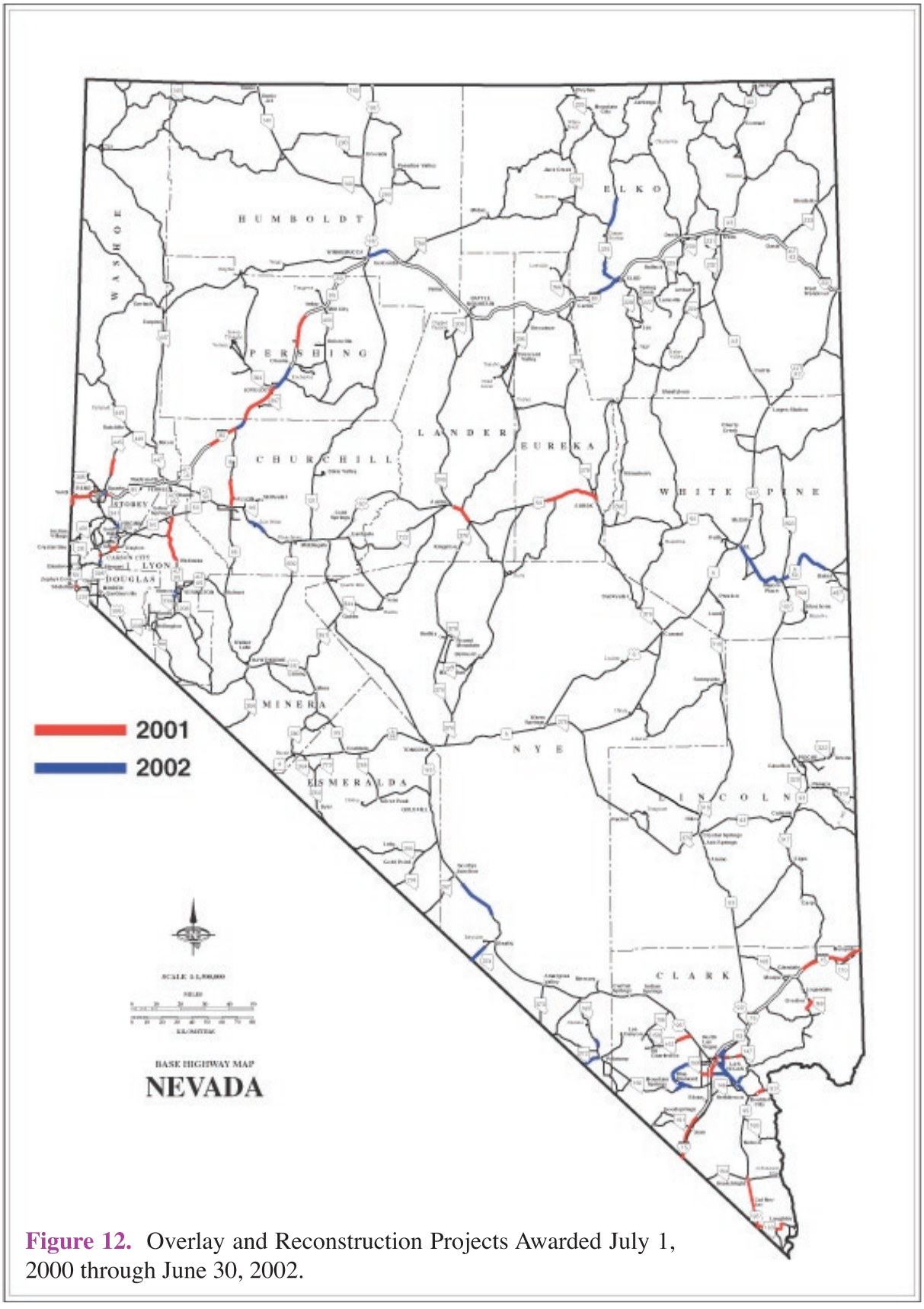



**Figure 12.** Overlay and Reconstruction Projects Awarded July 1, 2000 through June 30, 2002.

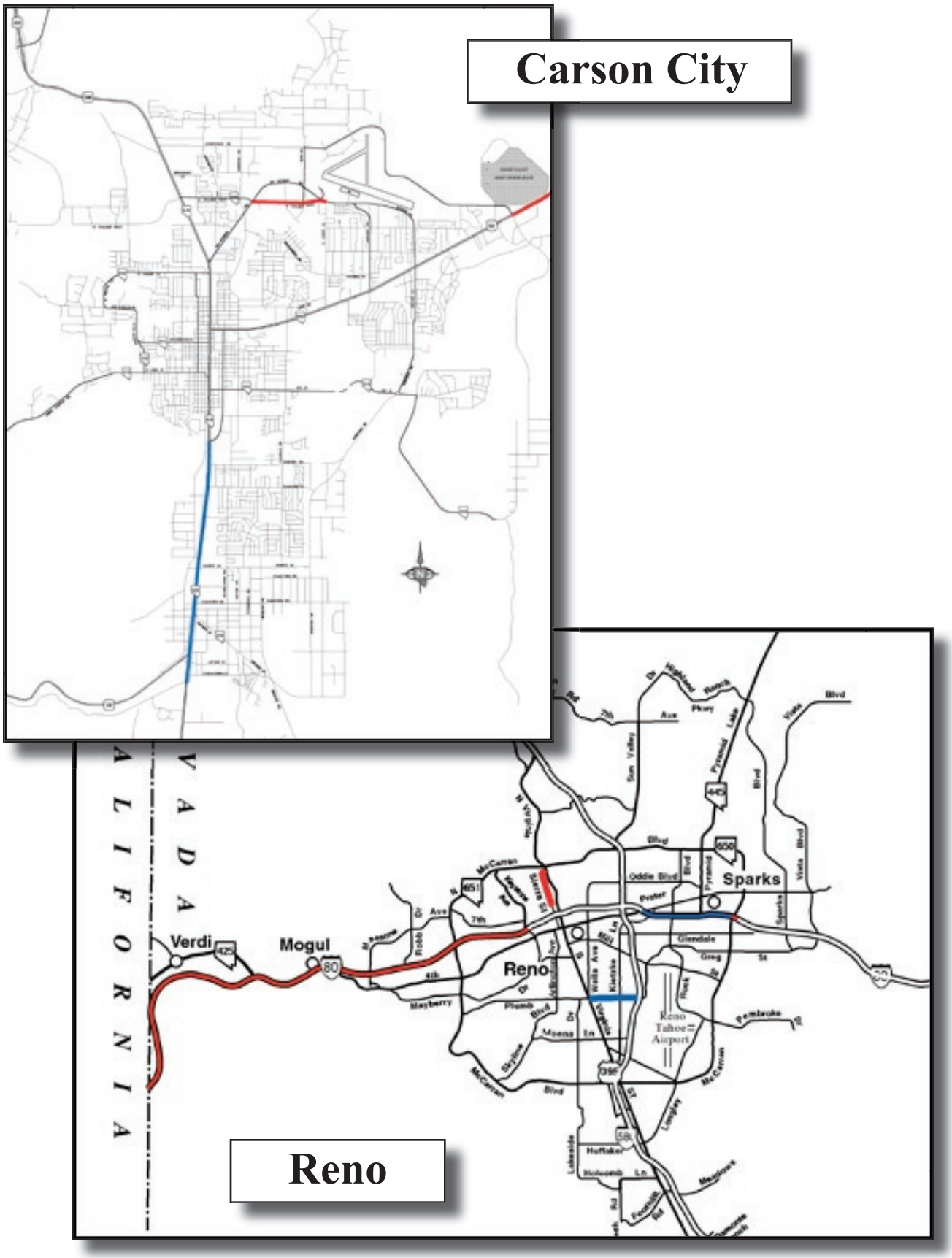



**Figure 12A.** Overlay and Reconstruction Projects Awarded July 1, 2000 through June 30, 2002.

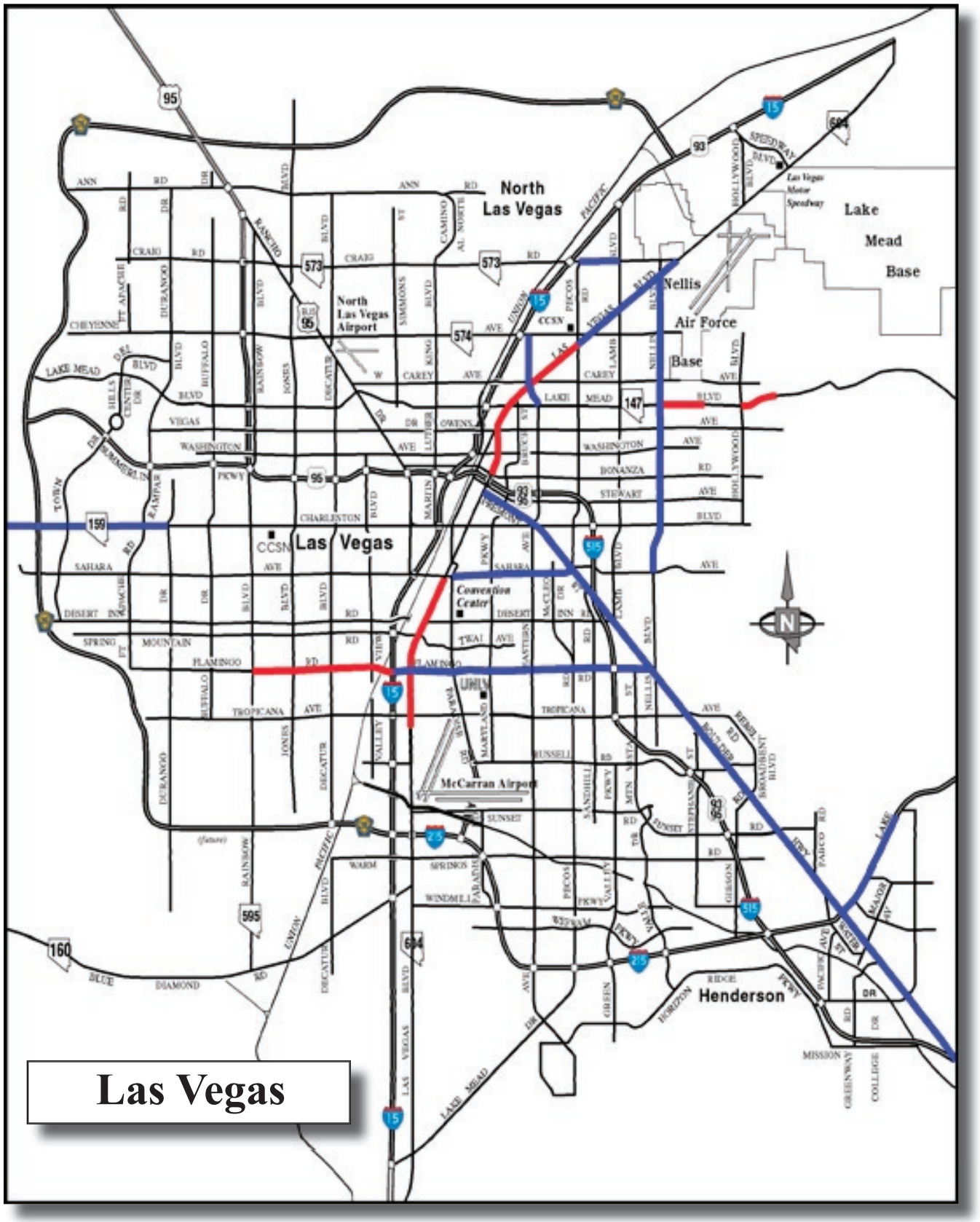



**Figure 12B.** Overlay and Reconstruction Projects Awarded July 1, 2000 through June 30, 2002.

*Pavement Condition Over Time* *(How has our pavement condition changed?)*

Figure 13 shows how the condition of our pavements has changed since 1985. Generally, the condition has remained fairly consistent, but since 1999, the miles needing overlay or reconstruction have fallen significantly, while those needing merely preventive or corrective maintenance have increased in response. A significant rehabilitation program in 1999 and 2000, along with a proactive action plan that was first detailed in our 1999 report, have significantly reduced the backlog of overlay and reconstruction work for 2003. Particularly impressive is that overlay needs have dropped by 1,185 miles (83 percent) since the 1999 report. Because we are focusing on timely overlays of high- to moderate-volume roads, while allowing some low-volume roads to deteriorate further, reconstruction needs have increased by 79 miles (20 percent) since the 1999 report.

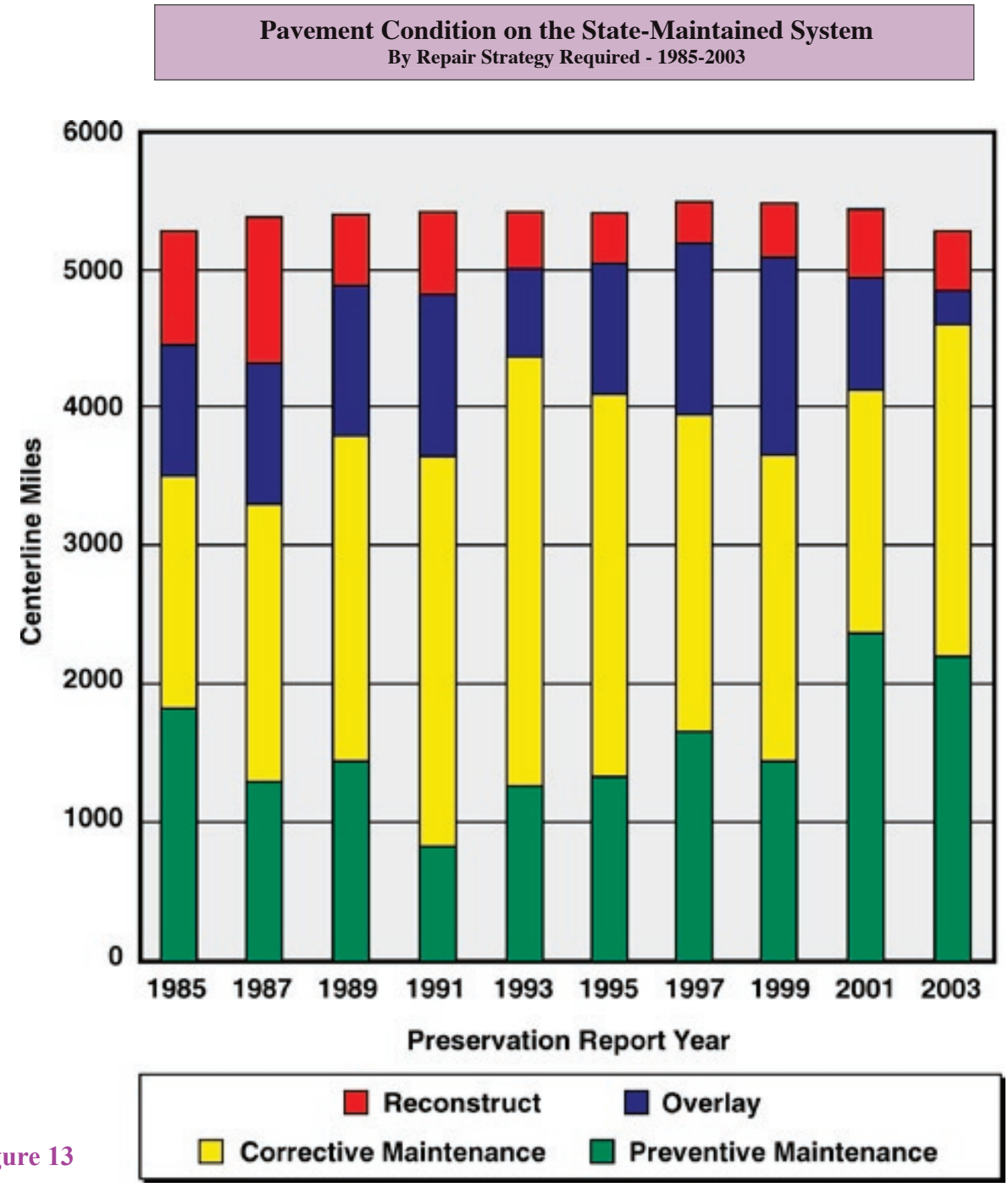



Figure 13

Figure 14 shows how the financial needs for pavement repairs have changed since 1985. Generally, the total needs increased with inflation until 1999, but have dropped considerably since then. Current needs are the lowest since the preservation reports were begun in 1985.

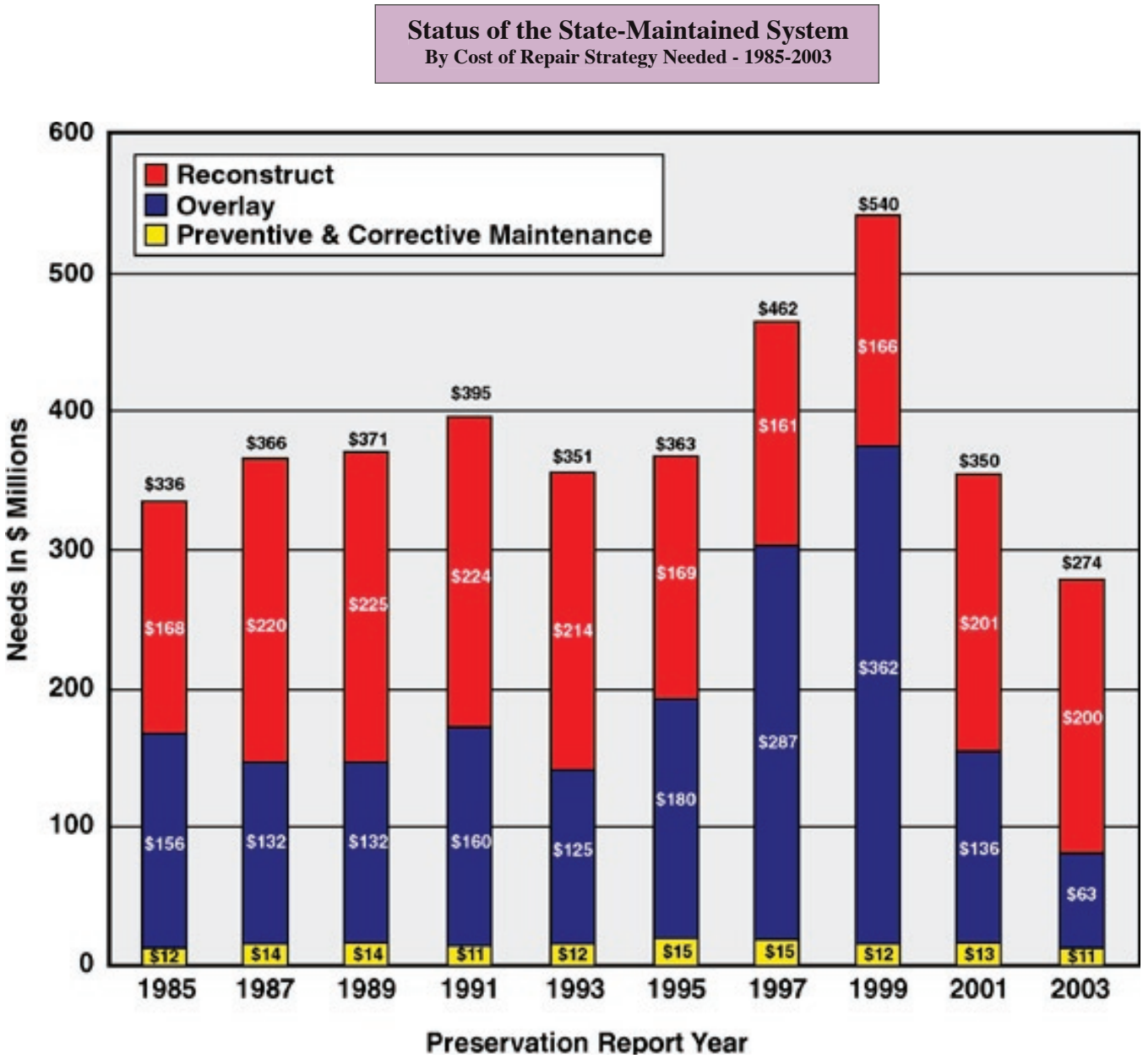



Figure 14

Figure 15 shows the financial needs for pavement repairs, as depicted in Figure 14, but inflation-adjusted to 2003.

**Pavement Condition on the State-Maintained System**

**Inflation Adjusted to 2003 Values Using Composite Consumer Price Index**

**By Cost of Repair Strategy Needed - 1985-2003**

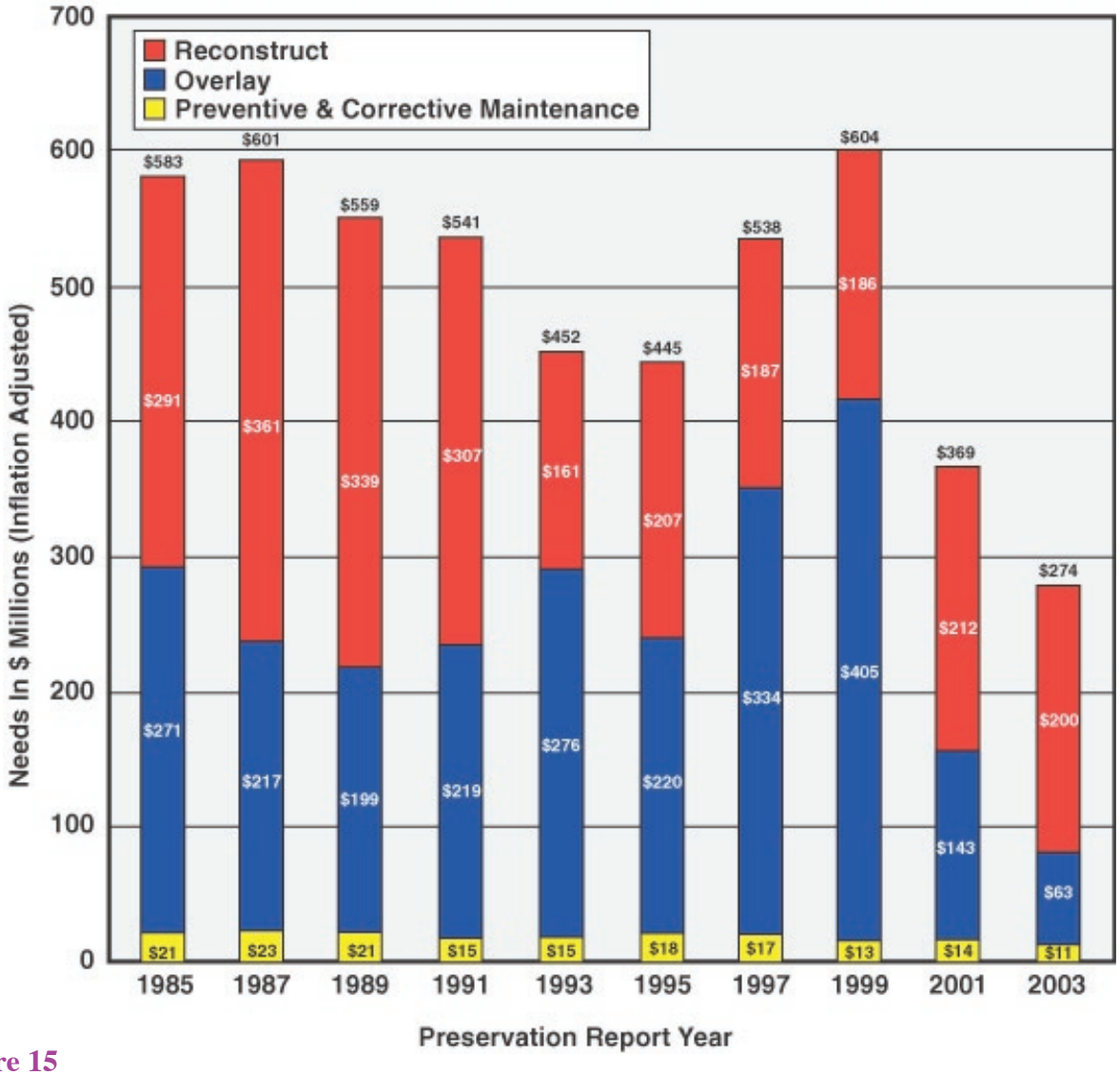



**Figure 15**

## BRIDGE PRESERVATION

A bridge is a structure spanning 20 feet or more that carries traffic over a depression or obstruction and includes multiple box culverts and pipes. Generally, bridge-preservation work consists of rehabilitating or replacing structurally deficient or functionally obsolete structures, seismically retrofitting earthquake-prone structures, sealing or replacing travel surfaces, and replacing worn joints.

Nevada's bridges represent a $1.2 billion investment. To detail how we are protecting that investment, this section provides information concerning bridge preservation funding, our bridge management system, the state's bridge inventory, the condition of our bridges, the cost to preserve the bridges, available and needed preservation funding, and an action plan for maintaining high-quality, low-cost bridges.

Although the focus in this section is on state-maintained bridges, information on other public bridges is also included because they are eligible for federal funds that are administered by the Nevada Department of Transportation. Furthermore, we are responsible for surveying and reporting the condition of these bridges.

### Funding *(How do we pay for bridge preservation?)*

Like pavement, we pay for bridges with fuel taxes and vehicle registration fees. About $15 million is spent annually on bridge preservation: $11 million in federal funds, $4 million in state funds, and $1 million in local funds. Historically, available funding has been sufficient to offset annual deterioration costs.

Federal funds are available for bridge replacement, rehabilitation, or seismic retrofits. To qualify for replacement, the bridge must be either functionally obsolete or structurally deficient and have a sufficiency rating less than 50. To qualify for rehabilitation, the bridge must be either functionally obsolete or structurally deficient and have a sufficiency rating less than 80. (Sufficiency ratings and functionally obsolete or structurally deficient bridges are defined in the Bridge Condition Survey section below.) About 85 percent of bridge funds are spent on bridge rehabilitation and replacement, and about 15 percent on seismic-retrofit work.

Under federal funding guidelines, "on-system" bridges must receive 65 percent of available federal funds and "off-system" bridges must receive 15 percent. The remaining 20 percent can be used on- or off-system. On-system and off-system status is determined by the functional classification of the roadway that the bridge carries. Of the 1,005 state bridges, 935 are on-system and 70 are off-system. Of the 552 county and city bridges, 291 are on-system and 261 are off-system.

### Bridge Management *(How do we care for our bridge assets?)*

Bridges are managed via our State Bridge Inventory System. This system provides an inventory of bridge condition and location, needed repairs, load limits, susceptibility to flooding, and ownership information. A separate inventory allows us to ascertain earthquake susceptibility and risks. Together, these inventories allow us to identify preservation priorities and monitor the state's progress toward eliminating the backlog of bridge work.

#### *Bridge Condition Survey* *(How do we assess our bridges' health?)*

The serviceability of bridges in Nevada is evaluated by use of a numerical assessment called the sufficiency rating. Sufficiency ratings vary from 0 to 100, with 100 being a bridge with no deficiencies. While

the sufficiency rating is primarily used to determine eligibility for federal funding, it also is used to assess the overall condition of a bridge. The sufficiency rating includes three components: a condition assessment, an inventory rating, and an appraisal rating.

Condition assessments are primarily a visual evaluation of the structure. The deleterious effects of age, environment, fatigue, hydrologic scour, settling, and traffic collisions are assessed. Each of the bridges in Nevada is inspected at least once every two years. Bridges in poor condition are inspected more often. Besides impacting condition ratings, visual inspections also affect a bridge's inventory rating.

The inventory rating denotes the strength of the bridge compared to design-truck loading. Structures with low condition or inventory ratings are classified as "structurally deficient." Structurally deficient bridges are not necessarily about to fail. Rather, they become a priority for corrective measures and may be posted for restricted vehicle usage.

The appraisal rating measures how well the bridge serves the public, or its functionality. Included in the appraisal rating are a structural evaluation and a review of the deck geometry, under-bridge clearance, waterway adequacy, and approach geometry. Under the appraisal rating, a substandard structure is termed "functionally obsolete." Like structurally deficient bridges, functionally obsolete bridges are able to serve the public, but are susceptible to congestion, collisions, or flooding because of their restrictive clearances and geometries. Although functionally obsolete bridges are generally not as great a concern as structurally deficient ones, they may also become a priority for corrective measures and may be posted for restricted vehicle usage.

Separate from the sufficiency rating, a bridge's susceptibility to seismic activity is considered when assessing its health. Nevada is the third most seismically active state behind California and Alaska. The central and western parts of Nevada are the most active, but southern Nevada does have the potential for damaging earthquakes.

## System Status *(What do we maintain?; What is its condition?; What is the cost to improve it?)*

### *Bridge Inventory* *(What do we maintain?)*

All bridges in Nevada which are open to the public are included in the Nevada Department of Transportation bridge inventory. There are currently 1,623 public bridges in Nevada. The Nevada Department of Transportation maintains 1,005; county or city governments, 552; federal agencies, 56; private entities, eight; and other state agencies, two.

### *Condition Survey Results* *(What is the condition of our bridges?)*

Generally, bridges with sufficiency ratings more than 80 can be considered good, ratings of between 50 and 80 can be considered fair, and ratings less than 50 are considered poor. Figure 16 shows the condition of Nevada's bridges. Figure 17 shows those bridges that are substandard.

Overall, Nevada bridges are in good shape compared to many other states. This is mainly due to our favorable environment and relatively "youthful" bridges. Most bridges have a useful life of at least 50 years. The age distribution for state bridges is shown in Figure 18.

*Continued on page 28.*

## Condition of Nevada's Bridges

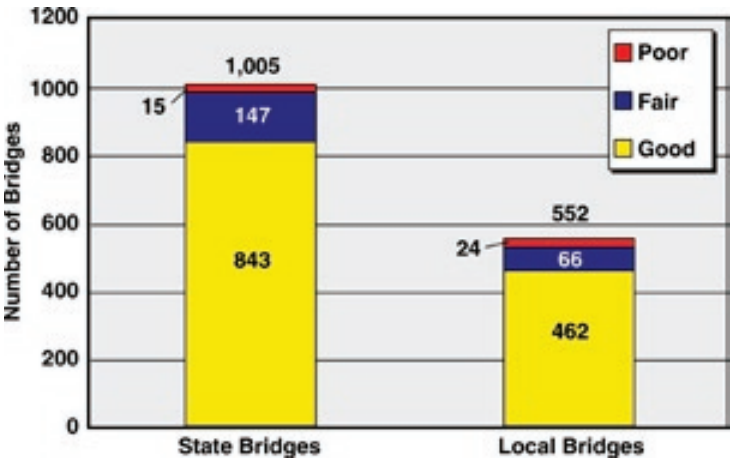



Figure 16

## Substandard Bridges

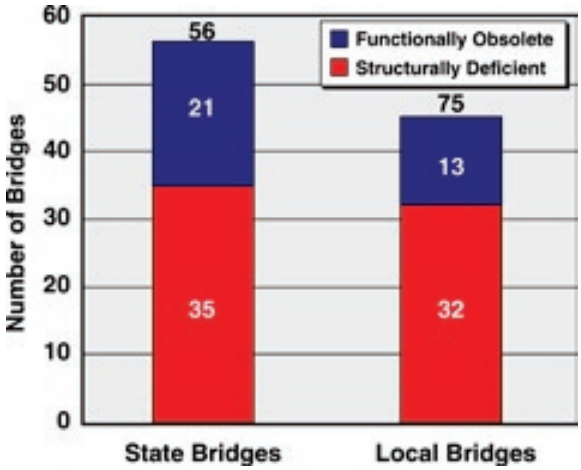



Figure 17

## When Were Our State Bridges Built

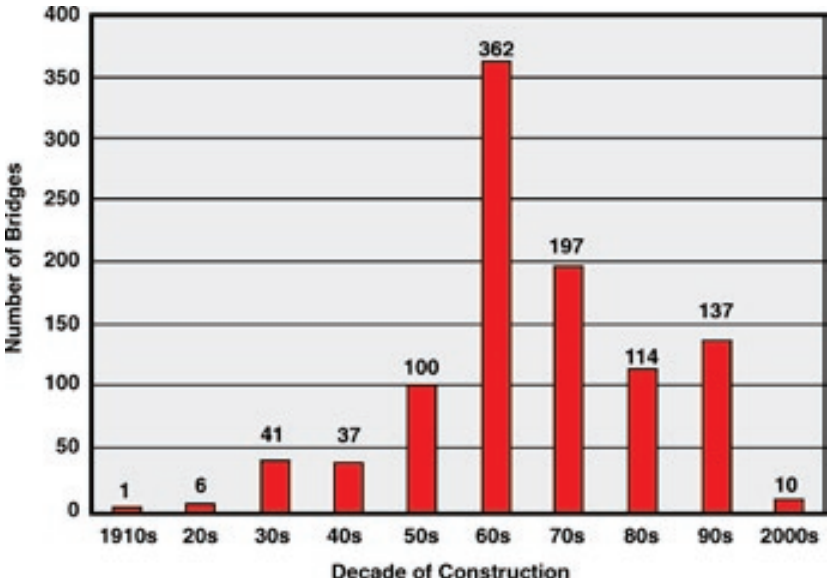



Figure 18

Since seismic prioritization began, NDOT has replaced or retrofitted nearly 70 structures at a cost of $23 million. However, NDOT has placed a high priority on nearly 215 more state-owned bridges in need of seismic retrofitting. The cost to upgrade these bridges is estimated at $65 million. There is inadequate information available to fully assess the need of retrofitting non-state bridges; therefore, no cost estimate has been made.

*Backlog of Bridge Work* *(What is the current cost to improve our bridges to good condition?)*

There is currently a $124 million backlog of state bridge work. Table 8 shows the needed repairs. Preventive maintenance needs are not included in the bridge backlog because this work is performed using our routine-maintenance funds. Figures 19 through 19G show the location of structurally deficient or functionally obsolete bridges.

**Backlog of Bridge Work**
**State Bridges - 2003**
Based on 2002 Condition Data

| | Repair Strategy Required | | | | |
|---|---|---|---|---|---|
| **System** | **Corrective Maintenance** | **Rehabilitation** | **Replace** | **Seismic Retrofit** | **Total** |
| Principal Arterial - Interstate | $8,547,000 | $14,478,000 | $607,000 | $_ | $23,632,000 |
| Principal Arterial - Non-Interstate | 6,256,000 | 5,067,000 | 4,960,000 | _ | 16,283,000 |
| Minor Arterial | 3,436,000 | 2,263,000 | 272,000 | _ | 5,971,000 |
| Major Collector | 3,490,000 | 2,489,000 | 3,476,000 | _ | 9,455,000 |
| Minor Collector & Local | 910,000 | 904,000 | 1,816,000 | _ | 3,630,000 |
| System Not Identified | | | | 65,000,000 | 65,000,000 |
| **Total** | **$22,639,000** | **$25,201,000** | **$11,131,000** | **$65,000,000** | **$123,971,000** |

**Table 8**

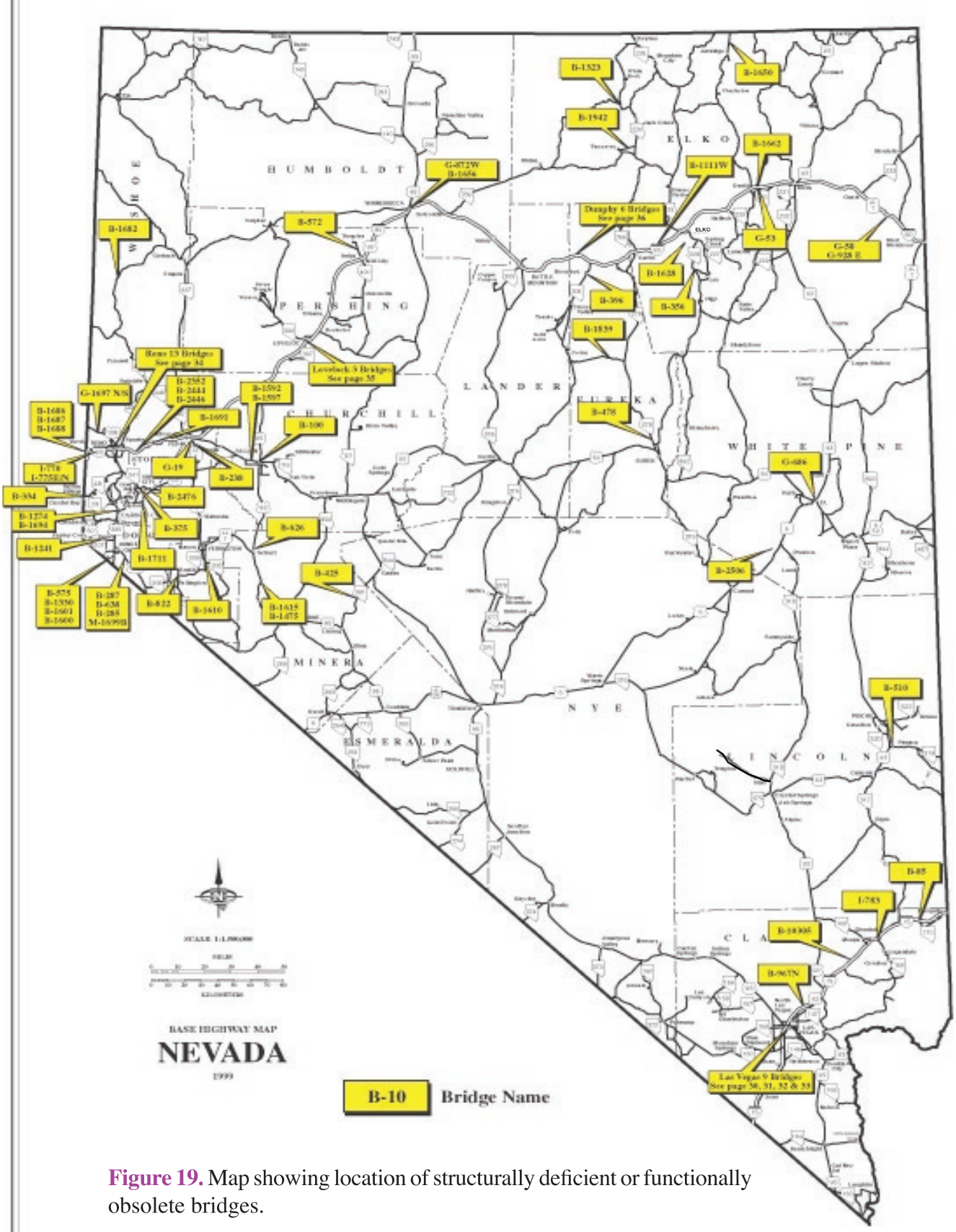



**Figure 19.** Map showing location of structurally deficient or functionally obsolete bridges.

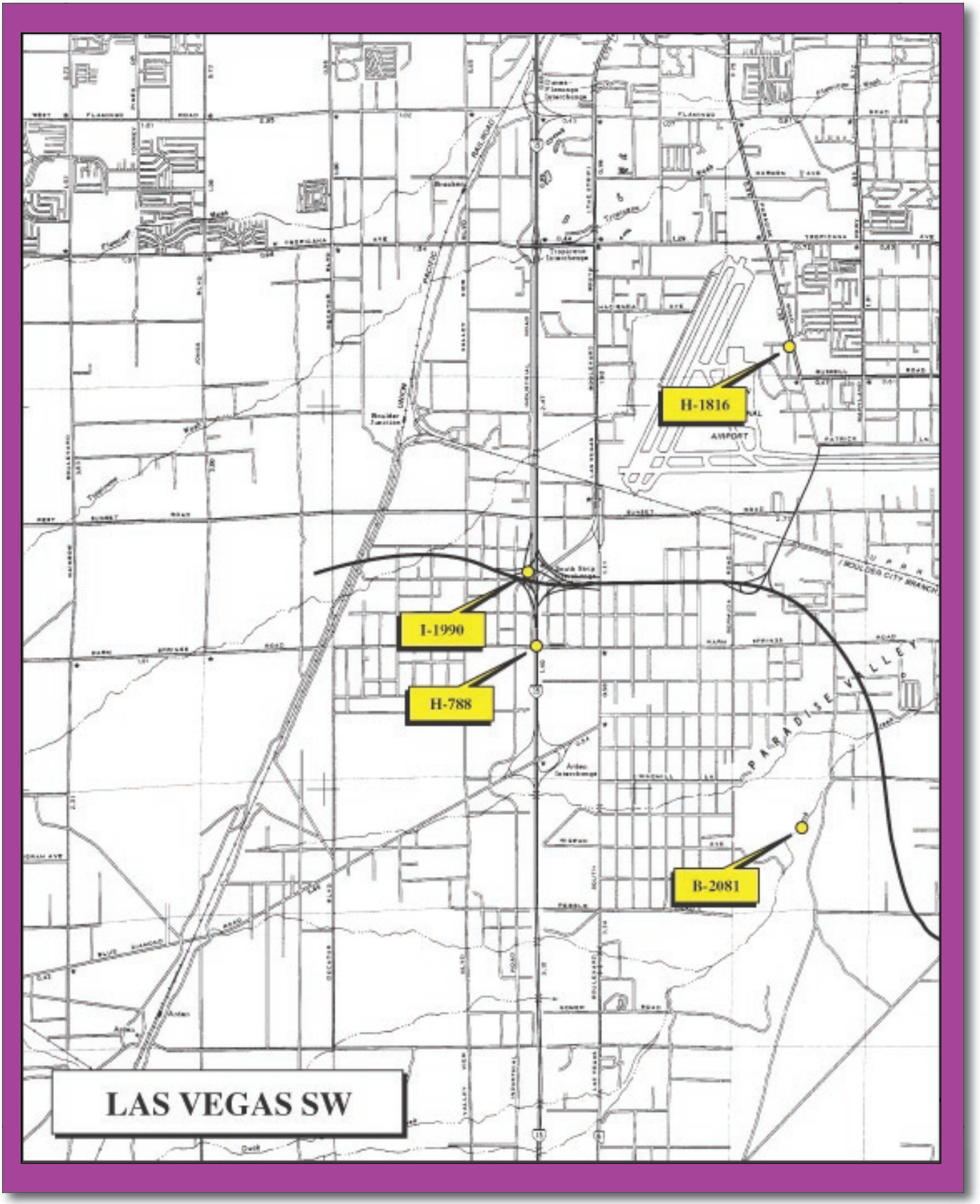



**Figure 19A.** Map showing location of structurally deficient or functionally obsolete bridges.

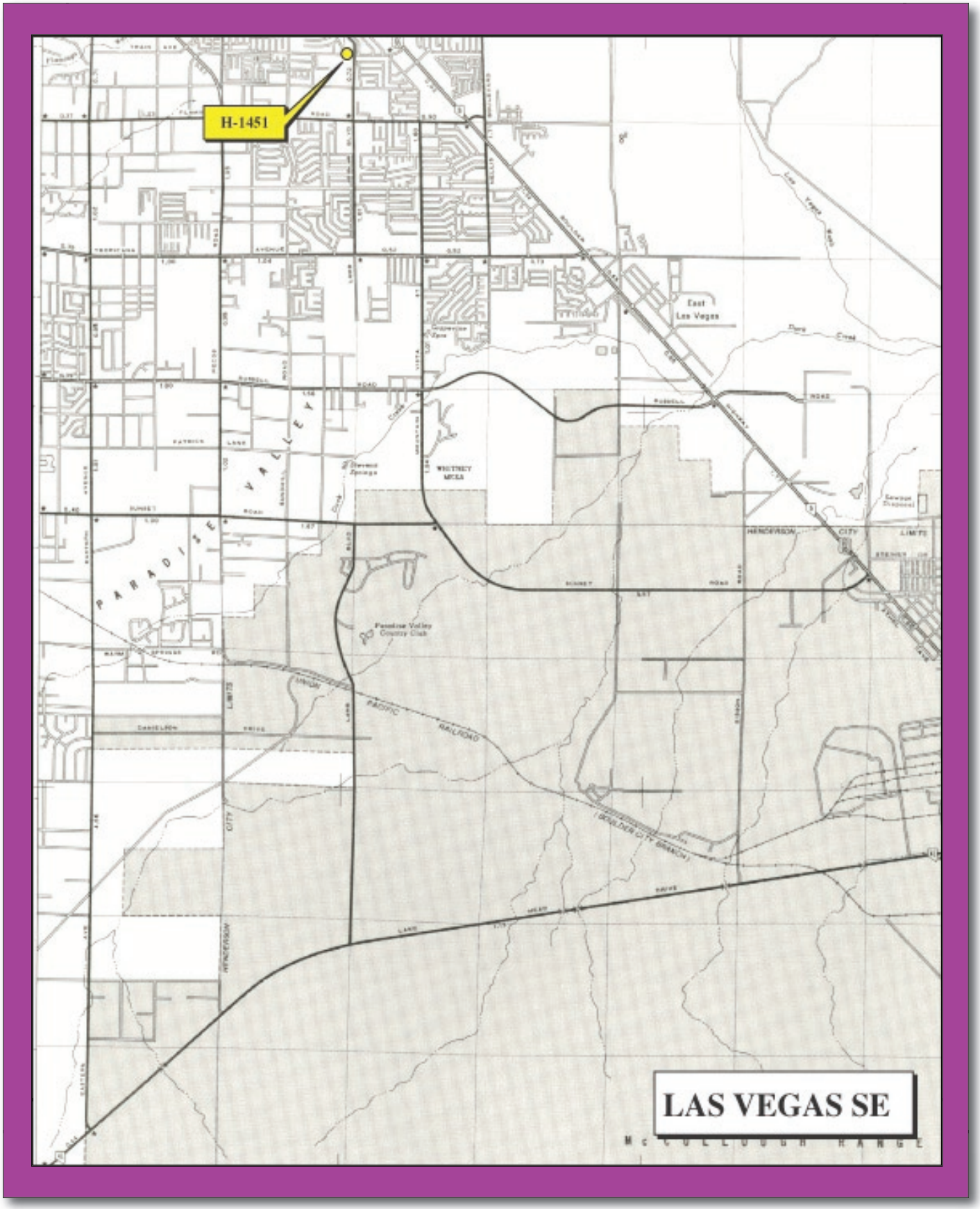



**Figure 19B.** Map showing location of structurally deficient or functionally obsolete bridges.

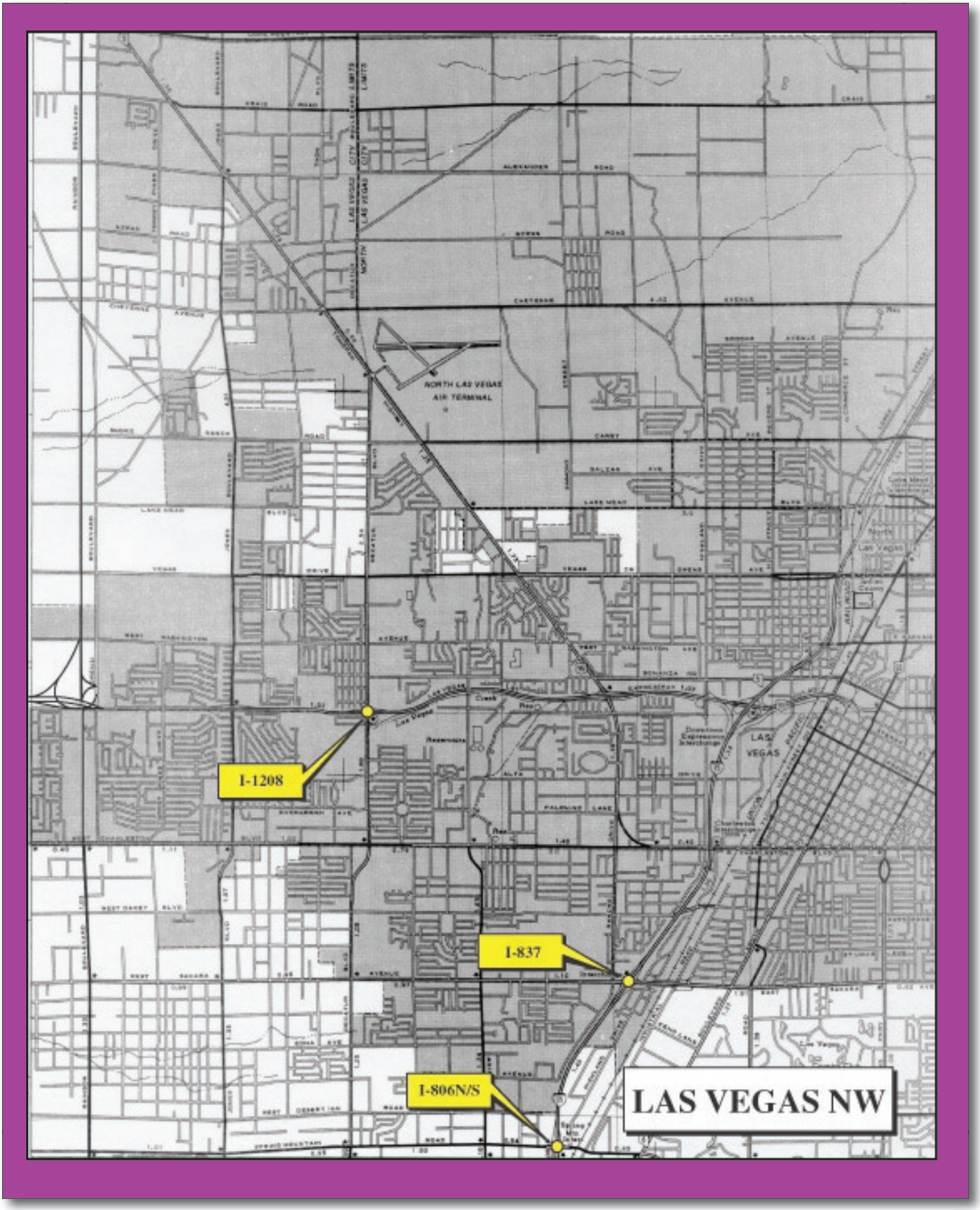



**Figure 19C.** Map showing location of structurally deficient or functionally obsolete bridges.

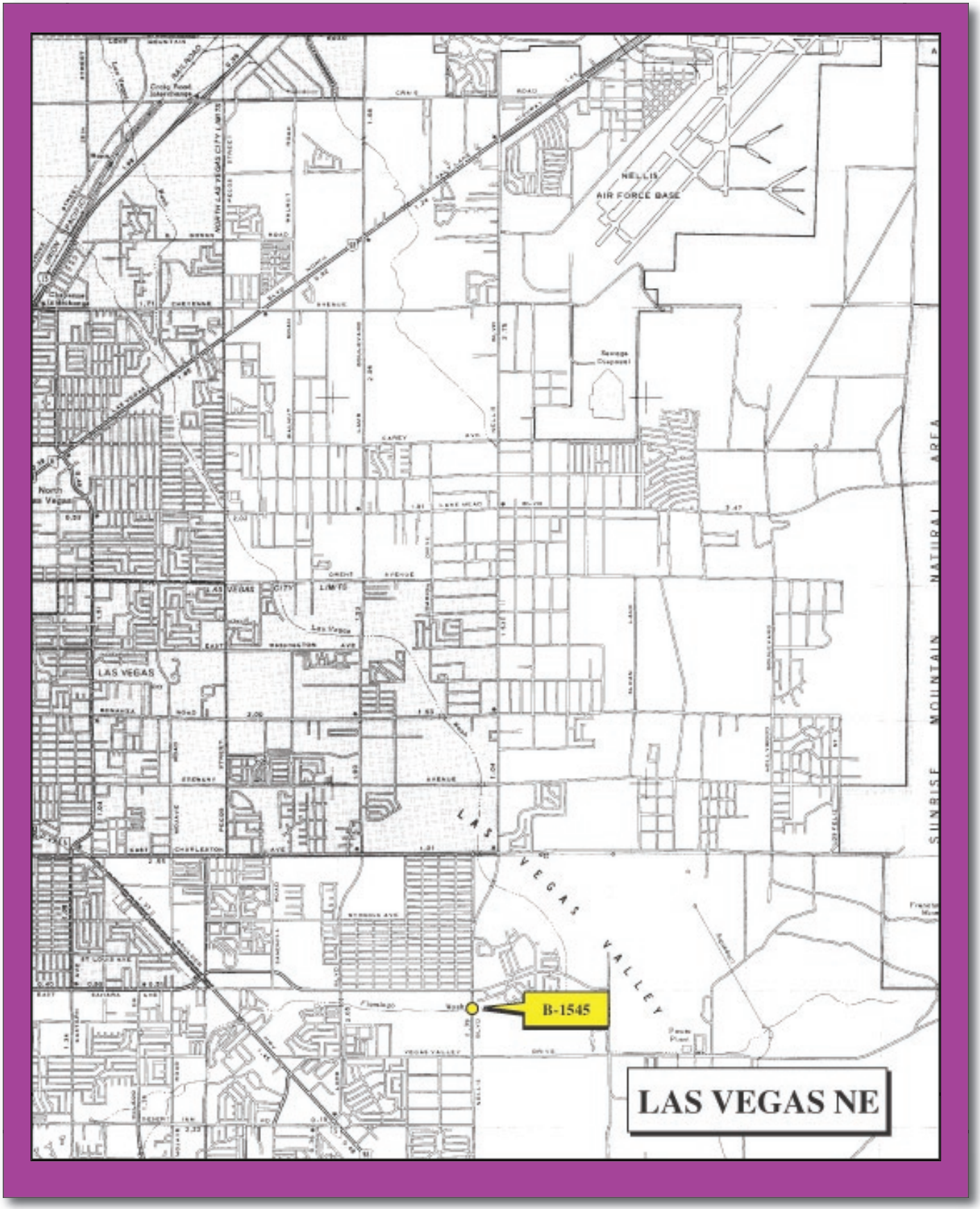



**Figure 19D.** Map showing location of structurally deficient or functionally obsolete bridges.

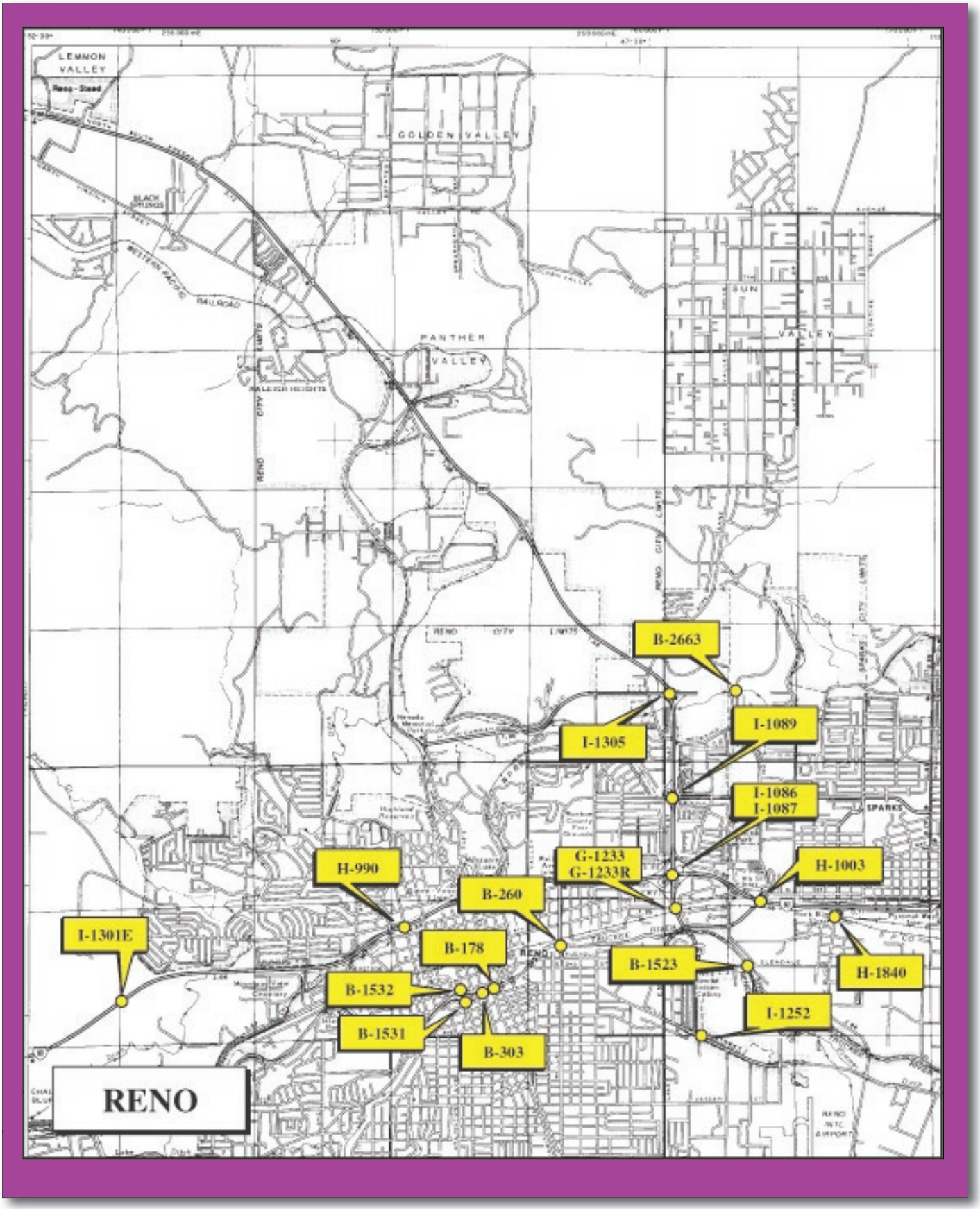



**Figure 19E.** Map showing location of structurally deficient or functionally obsolete bridges.

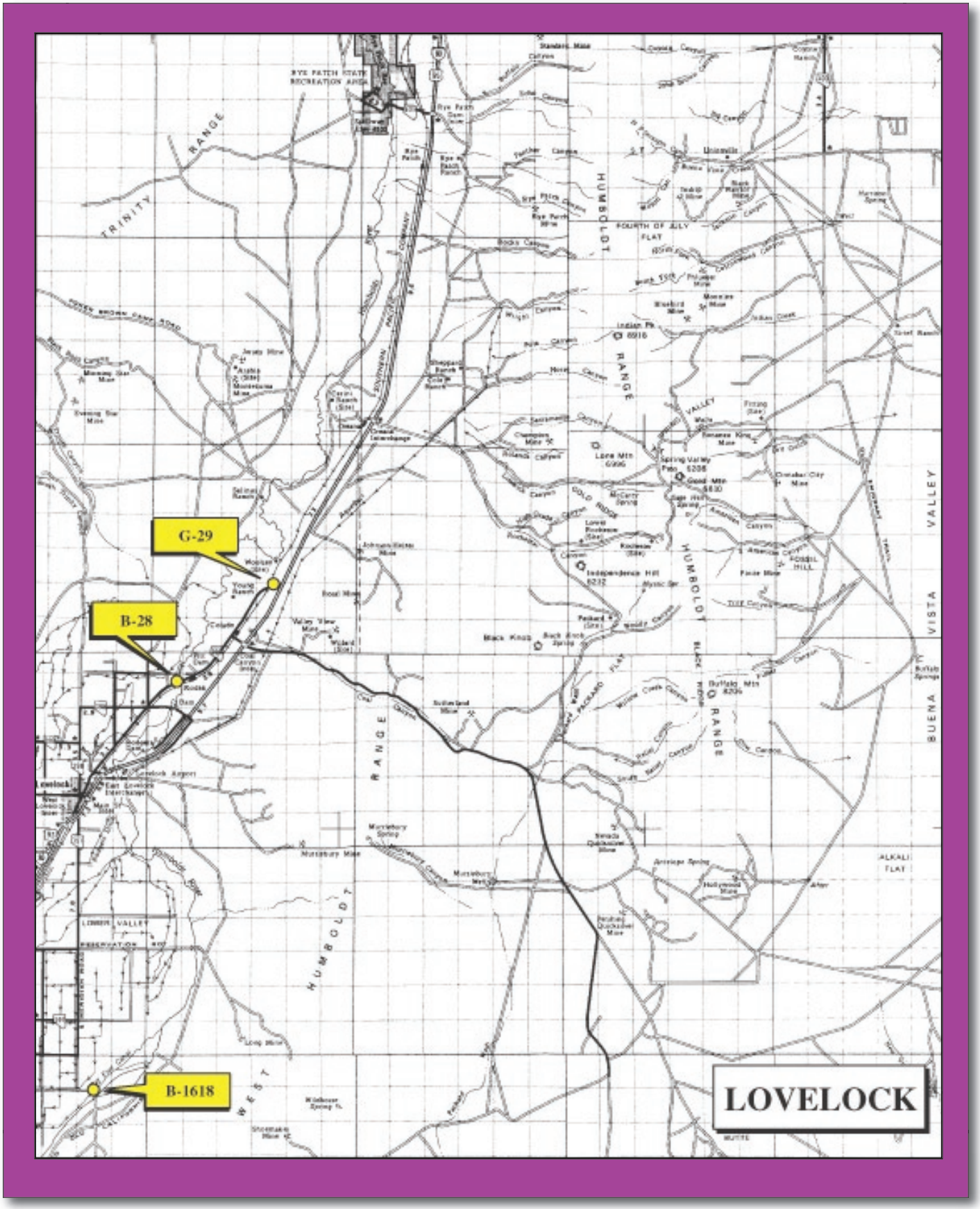



**Figure 19F.** Map showing location of structurally deficient or functionally obsolete bridges.

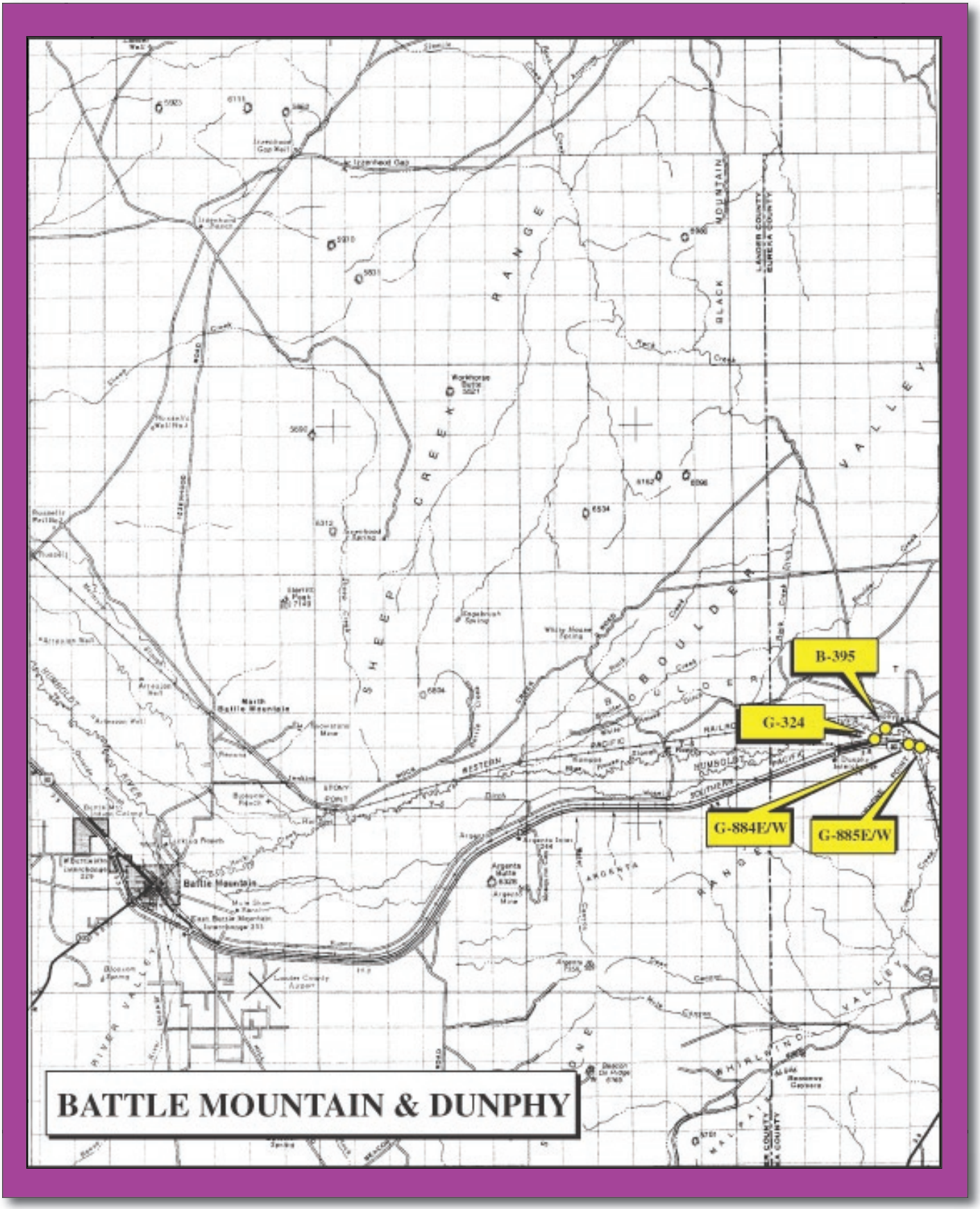



**Figure 19G.** Map showing location of structurally deficient or functionally obsolete bridges.

## 2003 Action Plan *(How will we improve our bridges?)*

To preserve Nevada's public bridges in good condition, our action plan in priority order is as follows:

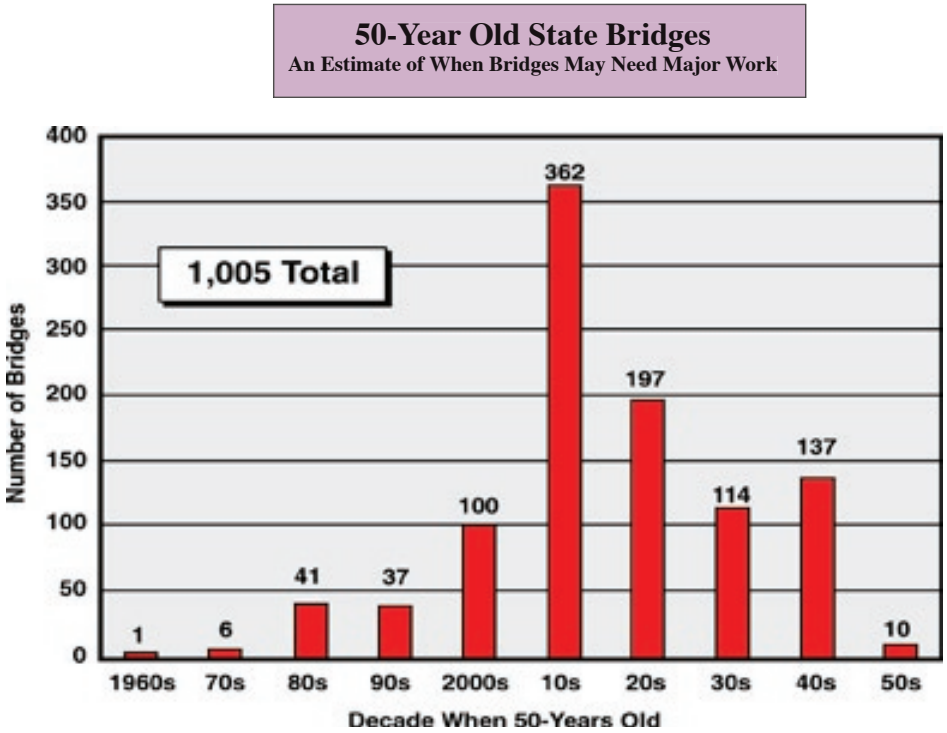
1. Replace or rehabilitate structurally deficient bridges before they become hazardous or overly burdensome to users.
2. Replace or rehabilitate functionally obsolete bridges before they become hazardous or overly burdensome to users.
3. Seismically retrofit bridges that do not meet current seismic standards.
4. Apply timely repairs to existing structures.

Generally, bridges with sufficiency ratings of less than 50 would fall under tasks 1 and 2. Just 3.0 percent (48 of 1,623) of Nevada's public bridges have sufficiency ratings that low. Only 1.4 percent (14 of 1,005) of the state bridges are rated that low.

Many of Nevada's most seismically vulnerable bridges have already been retrofitted. The others in task 3 above have been prioritized for seismic retrofit based on their importance and earthquake vulnerability.

## *Project Priority (How do we prioritize individual projects?)*

Bridge repairs are normally scheduled when pavement repairs are planned in the same vicinity. However, they may be planned separate from pavement work when we can repair several bridges together.




Our sufficiency rating system guides the prioritization of bridge replacement and rehabilitation work. Since the sufficiency rating contains factors for structural integrity, traffic use, and safety, it is an excellent prioritization tool.

Seismic retrofit work is prioritized based on a bridge's earthquake vulnerability and importance. We have investigated the seismic vulnerability of all state-owned bridges. Certain bridge types, such as culverts, do not need retrofit.

**Figure 20**

*Present versus Needed Funding* *(What financial resources are needed to improve our bridges?)*

The majority of state bridges were built between the mid-1950s and mid-1970s during Interstate construction. Since bridges normally have a useful life of 50 years or more, we can forward their construction date 50 years to estimate when the bridges may need rehabilitation or replacement. As shown in Figure 20 on the previous page, many will be due for major work beginning in 2010. Under the present user-fee structure, the current $124 million backlog of bridge work will increase to $142 million in 2015. The needed funding scenario, which requires small revenue increases in future years, will close out the backlog in 2015. Figure 21 and Table 9 show how these increases are needed to eliminate the backlog.

**Backlog of Bridge Preservation Work**
**With Present Funding vs. Needed Funding**

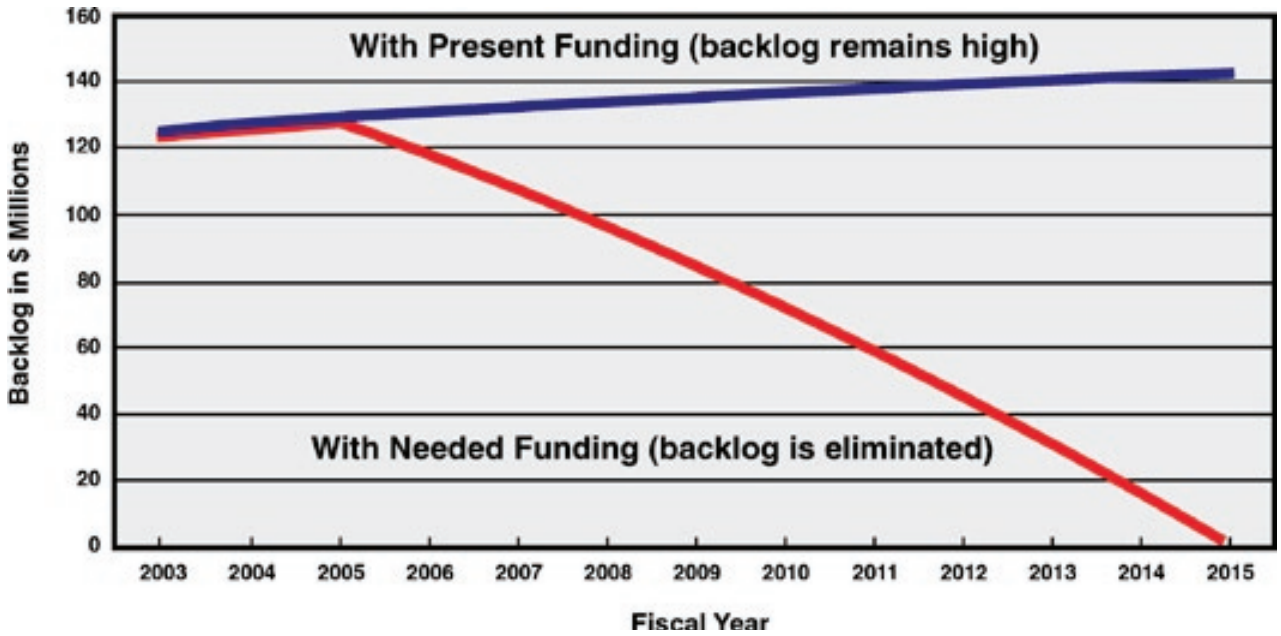



**Figure 21**

*Bridge Management System Improvements* *(How will we improve the management system?)*

To improve our management of bridge assets, we are implementing the use of PONTIS software that was developed by the Federal Highway Administration. The strength of PONTIS is its ability to prioritize bridge replacement, rehabilitation, and major maintenance. Our current sufficiency-rating method prioritizes only replacement and rehabilitation, but not major maintenance. Ultimately, PONTIS should provide more objective prioritization of bridge preservation.

*Continued on page 40*

# Bridge Backlog, Costs, and Funding
## State-Maintained System
(In Millions of Dollars)

### Present Funding

| Fiscal Year | Backlog of Bridge Work | Bridge Preservation Costs* (Normal Annual Deterioration Costs) | | | Bridge Preservation Funds** (Funds Planned for Preservation Work) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Corrective Maintenance, Rehabilitation, Replacement & Seismic Retrofit | Preventive Maintenance | Total | State Corrective Maintenance, Rehabilitation, Replacement & Seismic Retrofit | Federal Corrective Maintenance, Rehabilitation, Replacement & Seismic Retrofit | State Preventive Maintenance | | Total |
| 2003 | 124.0 | 13.4 | 0.3 | 13.7 | 2.3 | 9.1 | 0.3 | | 11.7 |
| 2004 | 126.0 | 13.8 | 0.3 | 14.2 | 2.4 | 9.5 | 0.3 | | 12.2 |
| 2005 | 128.0 | 14.2 | 0.4 | 14.6 | 2.5 | 9.8 | 0.4 | | 12.7 |
| 2006 | 129.9 | 14.7 | 0.4 | 15.0 | 2.6 | 10.2 | 0.4 | | 13.2 |
| 2007 | 131.7 | 15.1 | 0.4 | 15.4 | 2.7 | 10.6 | 0.4 | | 13.7 |
| 2008 | 133.4 | 15.5 | 0.4 | 15.9 | 2.8 | 11.1 | 0.4 | | 14.3 |
| 2009 | 135.1 | 15.9 | 0.4 | 16.3 | 2.9 | 11.5 | 0.4 | | 14.8 |
| 2010 | 136.6 | 16.4 | 0.4 | 16.8 | 3.0 | 12.0 | 0.4 | | 15.4 |
| 2011 | 138.0 | 16.8 | 0.4 | 17.2 | 3.1 | 12.5 | 0.4 | | 16.0 |
| 2012 | 139.2 | 17.3 | 0.4 | 17.7 | 3.3 | 13.0 | 0.4 | | 16.7 |
| 2013 | 140.2 | 17.7 | 0.4 | 18.2 | 3.4 | 13.5 | 0.4 | | 17.3 |
| 2014 | 141.1 | 18.2 | 0.5 | 18.6 | 3.5 | 14.0 | 0.5 | | 18.0 |
| 2015 | 141.7 | | | | | | | | |

### Needed Funding

| Fiscal Year | Backlog of Bridge Work | Bridge Preservation Costs* (Normal Annual Deterioration Costs) | | | Bridge Preservation Funds** (Funds Planned for Preservation Work) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Corrective Maintenance, Rehabilitation, Replacement & Seismic Retrofit | Preventive Maintenance | Total | State Corrective Maintenance, Rehabilitation, Replacement & Seismic Retrofit | Federal Corrective Maintenance, Rehabilitation, Replacement & Seismic Retrofit | State Preventive Maintenance | Needed Additional Bridge Preservation | Total |
| 2003 | 124.0 | 13.4 | 0.3 | 13.7 | 2.3 | 9.1 | 0.3 | 0.0 | 11.7 |
| 2004 | 126.0 | 13.8 | 0.3 | 14.2 | 2.4 | 9.5 | 0.3 | 0.0 | 12.2 |
| 2005 | 128.0 | 14.2 | 0.4 | 14.6 | 2.5 | 9.8 | 0.4 | 11.8 | 24.5 |
| 2006 | 118.1 | 14.7 | 0.4 | 15.0 | 2.6 | 10.2 | 0.4 | 12.3 | 25.5 |
| 2007 | 107.6 | 15.1 | 0.4 | 15.4 | 2.7 | 10.6 | 0.4 | 12.8 | 26.5 |
| 2008 | 96.6 | 15.5 | 0.4 | 15.9 | 2.8 | 11.1 | 0.4 | 13.3 | 27.5 |
| 2009 | 85.0 | 15.9 | 0.4 | 16.3 | 2.9 | 11.5 | 0.4 | 13.8 | 28.6 |
| 2010 | 72.7 | 16.4 | 0.4 | 16.8 | 3.0 | 12.0 | 0.4 | 14.4 | 29.8 |
| 2011 | 59.7 | 16.8 | 0.4 | 17.2 | 3.1 | 12.5 | 0.4 | 14.9 | 31.0 |
| 2012 | 46.0 | 17.3 | 0.4 | 17.7 | 3.3 | 13.0 | 0.4 | 15.5 | 32.2 |
| 2013 | 31.5 | 17.7 | 0.4 | 18.2 | 3.4 | 13.5 | 0.4 | 16.1 | 33.5 |
| 2014 | 16.2 | 18.2 | 0.5 | 18.6 | 3.5 | 14.0 | 0.5 | 16.8 | 34.8 |
| 2015 | 0.0 | | | | | | | | |

* Inflation assumed at 3.00% per annum.
** Revenue growth rate assumed is 4.00% per annum.

Note: Backlog of bridge work is as of beginning of fiscal year; preservation costs are those incurred during the fiscal year; and preservation funds are those that are available during the fiscal year.

Table 9

We will also develop a method to merge seismic-retrofit priorities with our replacement and rehabilitation priorities. Currently, seismic work is prioritized separately from other preservation work because no method exists to merge the two.

*Bridge Research* *(What research are we conducting to improve our bridges?)*

Since bridges represent a major investment, we must do what we can to make them perform as long as possible. Along those lines, we are researching creep and shrinkage prestress losses in concrete produced with Nevada aggregates to enable us to design and build better concrete beams. Also, major improvements have been made by our High Performance Concrete Task Force toward increasing the lifespan of bridges from 50 years to 75. High performance concrete will be fully implemented for bridges on the I-580 extension south of Reno.

We are researching seismic retrofitting for better earthquake resistance, and improved design methods for bridge columns under multi-directional stresses. We are also taking part in a pooled-fund project to establish and manage a bridge-training technical services program, specifically Load Resistance Factor Design for structural engineers.

## Historical Perspective *(How much have we expended on bridges?; How has their condition changed?)*

*Biennial Expenditures, Fiscal Years 2001-2002* *(How much have we expended on bridges?)*

During fiscal years 2001 and 2002, we obligated $45 million for bridge preservation work as outlined in Table 10.

**Bridge Expenditures for Fiscal Years 2001 and 2002**

| | Repair Strategy | | | | | |
|---|---|---|---|---|---|---|
| **Fiscal Year** | **Preventive Maintenance** | **Corrective Maintenance** | **Rehabilitation** | **Replacement** | **Seismic Retrofit** | **Total** |
| 2001 | $330,043 | $1,450,694 | $0 | $7,872,320 | $4,794,914 | $14,447,971 |
| 2002 | 299,795 | 1,836,723 | 0 | 25,468,249 | 2,563,928 | 30,168,695 |
| **Biennium Total** | **$629,838** | **$3,287,417** | **$0** | **$33,340,569** | **$7,358,842** | **$44,616,666** |

**Table 10**

During fiscal years 2001 and 2002, $41 million was spent to replace or seismically retrofit 24 bridges as outlined in Table 11.

**Number of Bridges Replaced or Seismically Retrofitted for Fiscal Years 2001 and 2002**

| | | Repair Strategy | | | |
|---|---|---|---|---|---|
| **Fiscal Year** | **Entity** | **On Federal-Aid System?** | **Replacement** | **Seismic Retrofit** | **Total** |
| 2001 | State | On-System | 1 | 7 | 8 |
| | | Off-System | | 2 | 2 |
| | Local/Other | Off-System | 4 | | 4 |
| 2002 | State | On-System | 2 | 6 | 8 |
| | Local/Other | Off-System | 2 | | 2 |
| | | **Total** | **9** | **15** | **24** |

**Table 11**

*Bridge Condition Over Time* *(How has the condition of our bridges changed?)*

Figure 22 shows that the condition of the state bridges has changed little since 1994. Figure 23 shows that the number of functionally obsolete bridges has declined compared to 1994, and the number of structurally deficient bridges has decreased compared to 1998.

Figures 24 and 25 show that the condition of locally maintained bridges has changed little since 1994, but there are significantly more bridges.

**Condition of State Bridges**

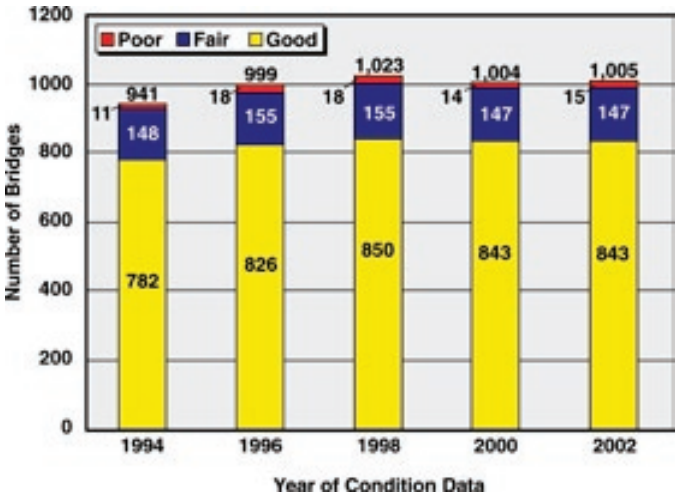



Figure 22

**Substandard State Bridges**

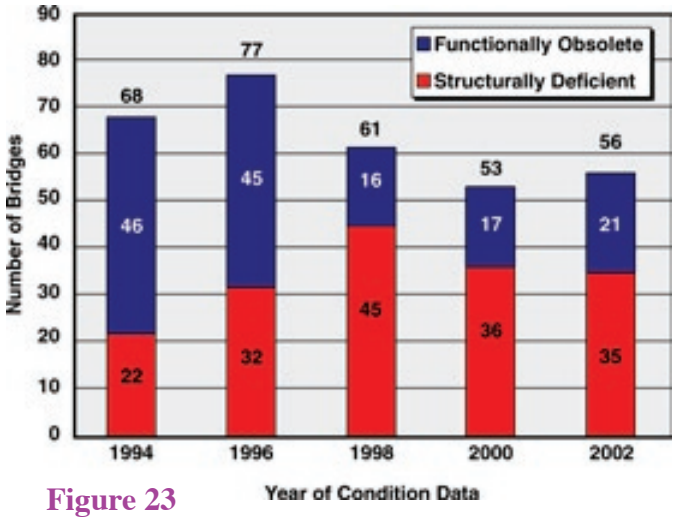



Figure 23

**Condition of Local Bridges**

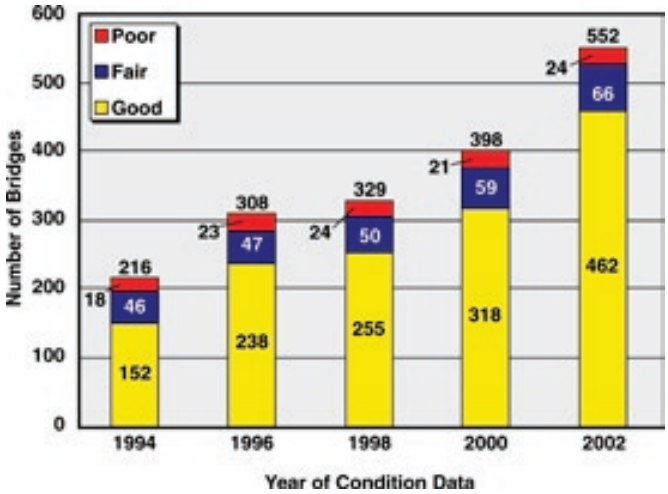



Figure 24

**Substandard Local Bridges**

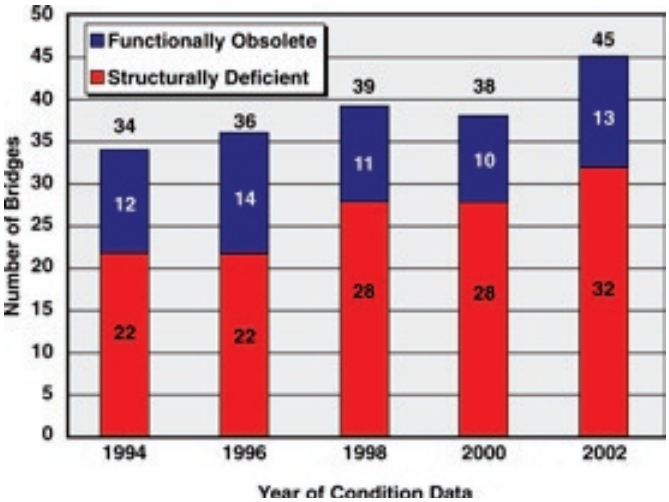



Figure 25

## PAVEMENT & BRIDGE PRESERVATION SUMMARY

Preserving our highways means preserving both pavements and bridges. Our combined pavement and bridge backlog is $387 million, as shown in Table 12. The funds needed to eliminate this backlog are shown in Figure 26 and Table 13.

### Backlog of Pavement and Bridge Work
**State-Maintained System - 2003**
**Based on 2002 Condition Data**

| System | Pavement | Bridges | Total |
|---|---|---|---|
| Principal Arterial - Interstate | $40,853,000 | $23,632,000 | $64,485,000 |
| Principal Arterial - Non-Interstate | 56,738,000 | 16,283,000 | $73,021,000 |
| Minor Arterial | 53,000,000 | 5,971,000 | $58,972,000 |
| Major Collector | 76,133,000 | 9,455,000 | $85,588,000 |
| Minor Collector & Local | 36,160,000 | 3,630,000 | $39,790,000 |
| System Not Identified | - - | $65,000,000 | $65,000,000 |
| **Total** | **$262,884,000** | **$123,971,000** | **$386,856,000** |

Table 12

### Backlog of Pavement & Bridge Preservation Work
**With Present Funding vs. Needed Funding**

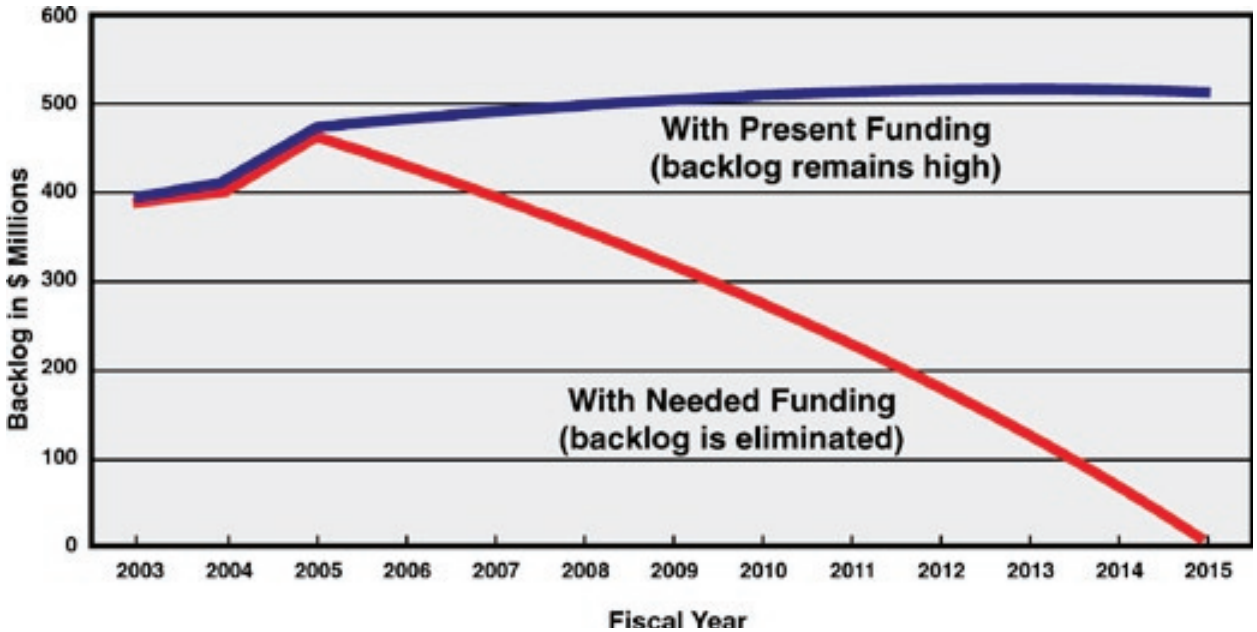



Figure 26

# Pavement & Bridge Backlog, Costs, and Funding
## State-Maintained System
(In Millions of Dollars)

### Present Funding

| | | Preservation Costs* (Normal Annual Deterioration Costs) | | | Pavement & Bridge Preservation Funds** (Funds Planned for Preservation Work) | | | |
|---|---|---|---|---|---|---|---|---|
| Fiscal Year | Backlog of Pavement & Bridge Work | Pavement Total | Bridge Total | Pavement & Bridge Total | State | Federal | | Total |
| 2003 | 386.9 | 152.0 | 13.7 | 165.7 | 109.1 | 38.2 | | 147.3 |
| 2004 | 405.3 | 156.5 | 14.2 | 170.7 | 59.5 | 51.8 | | 111.2 |
| 2005 | 464.7 | 161.2 | 14.6 | 175.8 | 108.8 | 53.8 | | 162.2 |
| 2006 | 477.9 | 166.1 | 15.0 | 181.1 | 114.9 | 56.0 | | 170.8 |
| 2007 | 488.1 | 171.0 | 15.4 | 186.5 | 119.3 | 58.2 | | 177.6 |
| 2008 | 497.0 | 176.2 | 15.9 | 192.1 | 124.0 | 60.6 | | 184.5 |
| 2009 | 504.5 | 181.5 | 16.3 | 197.8 | 128.8 | 63.0 | | 191.8 |
| 2010 | 510.5 | 186.9 | 16.8 | 203.7 | 133.8 | 65.5 | | 199.3 |
| 201 | 514.9 | 192.5 | 17.2 | 209.7 | 139.0 | 68.1 | | 207.2 |
| 2012 | 517.5 | 198.3 | 17.7 | 216.0 | 144.5 | 70.8 | | 215.3 |
| 2013 | 518.2 | 204.2 | 18.2 | 222.4 | 150.1 | 73.7 | | 223.8 |
| 2014 | 516.8 | 210.4 | 18.6 | 229.0 | 155.9 | 76.6 | | 232.6 |
| 2015 | 513.2 | | | | | | | |

### Needed Funding

| | | Preservation Costs* (Normal Annual Deterioration Costs) | | | Pavement & Bridge Preservation Funds** (Funds Planned for Preservation Work) | | | |
|---|---|---|---|---|---|---|---|---|
| Fiscal Year | Backlog of Pavement & Bridge Work | Pavement Total | Bridge Total | Pavement & Bridge Total | State | Federal | Needed Additional Overlay, Reconstruction & Bridge | Total |
| 2003 | 386.9 | 152.0 | 13.7 | 165.7 | 109.1 | 38.2 | 0.0 | 147.3 |
| 2004 | 405.3 | 156.5 | 14.2 | 170.7 | 59.5 | 51.8 | 0.0 | 111.2 |
| 2005 | 464.7 | 161.2 | 14.6 | 175.8 | 108.8 | 53.8 | 42.7 | 162.2 |
| 2006 | 435.1 | 166.1 | 15.0 | 181.1 | 114.9 | 56.0 | 44.5 | 170.8 |
| 2007 | 400.9 | 171.0 | 15.4 | 186.5 | 119.3 | 58.2 | 46.2 | 177.6 |
| 2008 | 363.6 | 176.2 | 15.9 | 192.1 | 124.0 | 60.6 | 48.1 | 184.5 |
| 2009 | 323.0 | 181.5 | 16.3 | 197.8 | 128.8 | 63.0 | 50.0 | 191.8 |
| 2010 | 279.0 | 186.9 | 16.8 | 203.7 | 133.8 | 65.5 | 52.0 | 199.3 |
| 201 | 231.4 | 192.5 | 17.2 | 209.7 | 139.0 | 68.1 | 54.1 | 207.2 |
| 2012 | 179.9 | 198.3 | 17.7 | 216.0 | 144.5 | 70.8 | 56.2 | 215.3 |
| 2013 | 124.3 | 204.2 | 18.2 | 222.4 | 150.1 | 73.7 | 58.5 | 223.8 |
| 2014 | 64.5 | 210.4 | 18.6 | 229.0 | 155.9 | 76.6 | 60.8 | 232.6 |
| 2015 | 0.0 | | | | | | | |

* Inflation assumed at 3.00% per annum.
** Revenue growth rate assumed is 4.00% per annum.

Note: Backlog of bridge work is as of beginning of fiscal year; preservation costs are those incurred during the fiscal year; and preservation funds are those that are available during the fiscal year.

Table 13

NOTES